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ABSTRACT

Every school, no matter how urbanized, has an outdoor locale that can be used to expand and enrich classroom learning. It may be the school yard, the surrounding grounds, or the managed and landscaped lawns or garden. Or perhaps a park or overgrown vacant lot is within walking distance. This guide will help elementary and junior high school teachers make effective use of any available outdoor site. The presentation is divided into the months of the school year, with suggestions about observations of the seasonal changes in time, weather, plants and animal life. The guide suggests that collecting should be done in very limited quantities to instill in students respect for all living things left in their own environment. The general recommendation is that nature study be used as an experience of discovery and sharing, in which family and volunteers can also take part. Some projects develop through the school year, whereas others are specific to a single month. There are suggestions about use of natural materials for food, art and decoration, science studies, history discussion, and mathematical calculation. The document contains 16 references. (DHP)

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Centering On . . .

Using the Outdoors to Enrich Learning

by Lenore Miller
P.S. 54R

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The New York City Teacher Centers Consortium

The Teacher Center Project supports the concept that in-service is most successful when the participant is a stakeholder who has been freely involved in all stages of staff development. The Teacher Center begins by assessing teacher needs and then plans and implements activities responsive to those needs. The environment of the service (in class, on-site, workshop, individual consultation, etc.) is suited to the needs of the participant. The Center utilizes the expertise of practicing teachers, often joining them with consultants, researchers, and scholars.

The Project offers on-site support services, in a collegial setting, to individuals and groups of New York City teachers who want to examine, develop, or try out instructional strategies, classroom management procedures, or curriculum approaches. A variety of staff development methods are applied, including consultation, demonstration, modeling, training, and coaching.

Its outreach programs include after-school courses and workshops based on the professional needs and interests of teachers; technical assistance to schools and districts in the implementation of new programs and priorities; and citywide conferences and institutes tailored to the needs of the educational community.

It is the mission of the Teacher Center to promote professionalism, foster collegiality, help improve the school as a workplace, and work toward heightening teachers' sense of efficacy, so as to enable them to recapture their sense of control and purpose in their professional lives.

A listing of the staff and sites of the Teacher Centers and its Policy Board members appears on the covers of this book.

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Contents

Foreword 5

About the Author 7

Author's Introduction 9

September 11

October 15

November 19

December 23

January 29

February 35

March 39

April 43

May 47

June 53

Bibliography/Recommended Books 59

Some Helpful Agencies 61

Table of Contents by Specific Topic 63

Teacher Center Staff and Sites 65

Teacher Center Policy Board 65

Foreword

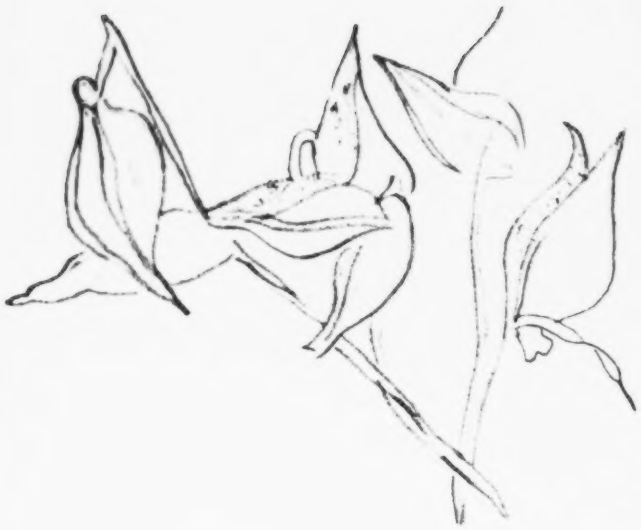
The New York City Teacher Centers Consortium is involved in the development of teacher-created educational materials and their dissemination to classrooms throughout New York City to enhance and enrich teaching and learning. This book, written by New York City teacher Lenore Miller, is a welcome addition to the Project's diverse products. The instructional activities presented within have been tried out by teachers in classrooms and have been found to be effective in meeting needs of students. These strategies can be used to stimulate individual creativity or in conjunction with the ongoing classroom science program as well as other areas of the curriculum.

Special thanks are due to Clare Cohen, Assistant Director of the Teacher Centers, for her coordination of the publication process, and Norma Jackson, Teacher Centers Office Associate, for her technical assistance.

In our effort to promote the sharing of successful teaching practices within and among schools, we invite teachers' comments and encourage you to submit your original books and other educational materials to us for possible future publication.

Please send to: New York City Teacher Centers
Consortium—Publications
48 East 21st Street—6th Floor
New York, NY 10010

Myrna Cooper
Director



About the Author

LENORE MILLER has been a teacher in the New York City public schools for more than 20 years, as well as a teacher and guide at High Rock Park and Conservation Center, Staten Island, New York, and a nature specialist at several area childrens' camps.

She is also the author of several publications in the areas of environmental education and most recently, the nature columnist for the *Staten Island Advance*. She is presently at work on a new book, scheduled for publication early in 1986 by the American Camping Association.

Ms. Miller has been awarded the prestigious National Wildlife Federation Fellowship, and is the 1985 recipient of the Presidential Award for Science Teaching bestowed by Long Island University.

Her educational background spans the fields of psychology, elementary education and environmental conservation education, and includes extensive study in the areas of field botany, ornithology, behavioral ecology and science, technology and human values.

The author wishes to acknowledge Mr. Alex Savitz, principal of P.S. 54, Staten Island who originally suggested the writing of this guide.

Author's Introduction

Every school, no matter how urbanized, has an outdoor locale that can be utilized to expand and enrich classroom learning. It may be the school yard, or surrounding grounds, or the managed and landscaped lawns or garden. Or, perhaps a park is within walking distance. A friendly neighbor might allow the children on his or her property. Or, maybe there's just an overgrown vacant lot. No landscape is without its living components—even the man-made and built environments offer opportunities for investigation that demonstrate our relation to the natural world.

This guide has been prepared to help you utilize any outdoor site effectively. It is divided into the months of the school year and should be referred to at the beginning of each month.

It can be adapted for children from kindergarten through junior high school. It is appropriate for the range of ability levels; it provides activities to respond to the needs of special education students as well as to enrich the curriculum for gifted children.

When using this guide, please keep the following in mind:

1. Nature is always in a state of change, never static, never the same. Although it follows the calendar, nature doesn't always adhere to an exact timetable. Every outdoor locale is different and the plants or animals mentioned may not be present. Others not mentioned may well be. It is not meant to be complete.

2. Do not be overly concerned with proper identification or names of species. As adults, we often do not feel satisfied until we know the "name" of something, but that is of secondary importance. Instead, lead children to examine closely and perceive the characteristics of the organism. When they have discovered by and for themselves the characteristics that make one species different from another, and identification is sought *on their own*, then the name will be remembered.

continued on following page

Author's Introduction *continued*

3. Look upon the outdoor excursion as a discovering and sharing experience with your pupils. The spirit of "Let's find out together" should prevail. Removed from the restrictions of the classroom and books, the natural curiosity of children should be allowed to blossom and flourish (pun intended). Join your students in the co-operative venture of learning together out of doors. You will be refreshed and your teaching rejuvenated.

4. Be safety conscious. Obtain a permission slip for outdoor walks, signed by parents. Walk outside first so that you can steer clear of potential trouble spots, especially where land is not developed. Be alert to poison ivy. Learn to recognize it and teach your pupils how to identify it. If you're not sure, remember "Leaves three, let it be." Also, train your students to check each other's hair and clothes for ticks if you do go into any woods. Look for thorn bushes, broken glass or other possible dangers to your pupils.

5. Try to avoid expressions of revulsion or distaste for anything in the natural environment. It is incumbent upon teachers to influence the feelings of children in a positive way. No one is forced to love spiders or earthworms, etc., but don't allow your personal distaste to color the attitudes of children. Teachers are usually good actors when necessary, so pretend you "love them" (or at least find these creatures interesting) even if you don't.

6. Don't hesitate to share your ideas with other teachers. Sometimes your pupils can act as *your* guide and lead you into interesting avenues of learning.

7. Adapt suggestions to your pupils' level.

8. Be alert to the many possibilities that will exist for integrating your Social Studies, Math, Language Arts, etc., learnings with the outdoor program.

9. Consider using a separate or special notebook for outdoor lessons. This could either be a personal notebook for each student (small, with pen or pencil attached). In it, the child can record notes, observations, perceptions, feelings, drawings or even taped specimens for later study. Or it could be a class notebook where the class records class observations—sort of an experience chart book, but ongoing and permanent.

10. You will find that a small, inexpensive hand lens is a vital discovery tool. Through the lens, many tiny aspects of the natural world become observable. Each pupil should have one to use for field lessons. You should collect and store these after each use (to prevent loss).

11. Try to enlist the help of parents, retirees (grandparents?), student teachers or any interested volunteers. In this way, you'd be able to break your class into a more manageable unit of 10–15 pupils. There will be more personal involvement that way.

12. Last, but certainly not least, *ENJOY*! Nature is a beautiful gift for us to marvel at and derive pleasure from.

September

"In the early years, we are not to teach nature as a science, we are not to teach it primarily for drill: we are to teach it for loving."

—Liberty Hyde Bailey

September

September, when school begins, is a good time to begin working out of doors. Botanically, it is late summer, rapidly coming to a close as the first day of autumn occurs in mid-September. Perceptible changes are occurring.

1. Gradual shortening of the day. As we approach the autumnal equinox about September 20–22, children can observe the relative numbers of daylight/darkness hours. Have them note (and record) when and where sunrise and sunset occur. For example, every Friday, have them record the exact place where the sun rises and/or sets (if they are awake). Use a stationary landmark to focus place. . . to the left of the chimney of X house. They can also explore shadows—where, how long they are, etc. Assign this for homework every Friday. Or, if it's visible, make a point of observing the sun from your classroom window at a set time every week, e.g., 2:30 p.m. every Friday.

2. Gradual lowering of temperature. Have them observe and record such things as: how many children wore sweaters, or heavy jackets on a series of days starting in September and continuing. This points out the change in temperature over a longer period. Also, they might observe and record on what date heat had to be turned on in school or home.

How do these changes affect plants and animals of an area?

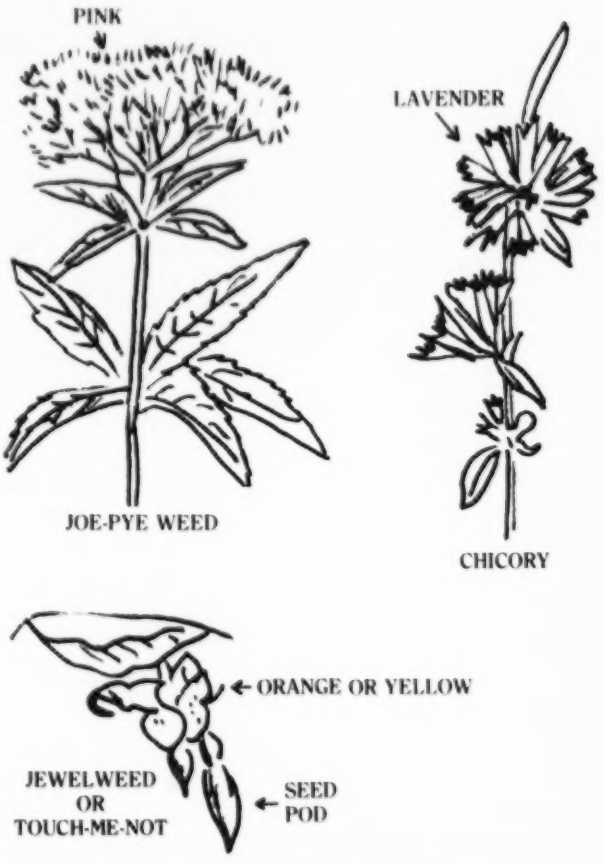
3. Observe the migration of monarch butterflies. Their south-westerly flight is very apparent at this time of year. Note where they stop to rest and nourish themselves. How far do they travel? How long does it take them? Is it the same butterfly that came North in Spring, or its offspring?

4. Observe the migration of birds. Which ones go? Which ones stay? Why do they go? Where do they go? Be sure to look upward, as most birds do their migratory flying at a higher altitude than other flying.

5. What animals or evidence of animals are visible? Look for squirrels, birds, mice and of course, insects of all kinds. What activities are they engaging in at this time of year? Look for cracked nuts, piles of seeds, leaves, webs, cocoons, etc.

6. Look at plants. Observe the most striking difference between various habitats of your site, especially if you have a field and woods. The most startling difference is the trees, of course. Observe the shade in the woods, the lack of shade in the field. Observe the different kinds of plants present in each very different habitat, as a result of this difference in light.

7. Compare the lawn (managed plants) with any wild area. Look at the *kinds* of plants and the *number* of plants. Think about the resulting animal life.



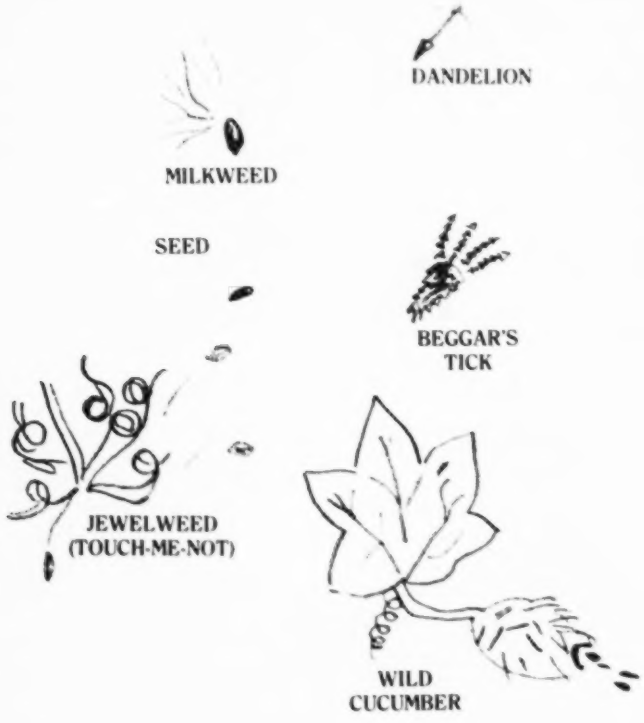
8. Look at flowers. What flowers are blooming at this time of year? Most of them are members of the *composite* family (posssessing multiple flowers on one blossom).

Identify, if you can, any, such as chicory, goldenrod, joe-pye weed, jewelweed (touch a seed pod; then you'll know why this plant is also called "touch-me-not"), and boneset. You may find Queen Anne's Lace, asters and other flowers characteristic of late summer.

9. Look at pollen. Brush some on your fingers. Use a lens to look closely (or put a few grains under a microscope). Discuss hay fever. Much ragweed grows in abused places—and ragweed has been designated the culprit in causing those seasonal allergies. Does it warrant this blame?

10. Note the beginnings of leaf color changes. What causes these changes? Admire and be inspired by this beauty.

11. Note the beginnings of the loss of the leaves (by deciduous trees). Why and how do trees lose their leaves in autumn?



12. Look for the development of seeds and their means of dispersal. Some are windblown (dandelion, milkweed); some stick to clothes and are carried away (trefoil, burdock); some are expelled (wild cucumber, jewelweed). Many of these can be found in every area. Some seeds could be collected, examined, classified, planted, identified. Try to find unusual places where plant seeds have fallen, and plants are growing, e.g., cracks in sidewalks, rain gutters.

N.B. A word about "collecting." Collecting of any kind should be done in very limited quantities. Instill in students, at an early age, the respect for all living things, left in their own environment. Any rock or board, turned over for examination, should be returned to its position. Any seeds or leaves or fruit or flowers taken from the natural area will not fulfill its natural destiny. For instructional purposes, there certainly could be limited collecting, but use discretion. *Never* take anything that there is just *one* of—you may be taking the last one!

13. Collect a few samples of fallen leaves. Press them for use in later art activities.

14. Observe and point out any areas that are littered with debris. Don't be afraid to express your revulsion at this! What kind of litter is most damaging to the land—paper, bottles, plastic or food? What can be done about it? You and your students might be motivated to clean up an eyesore.

The possibilities for the use of the outdoors as an extension of the classroom are unlimited.

October

"Nature study. . . consists of simple truthful observations that may, like beads on a string finally be threaded upon the understanding and thus held together as a logical and harmonious whole."

—Anna Botsford Comstock

October

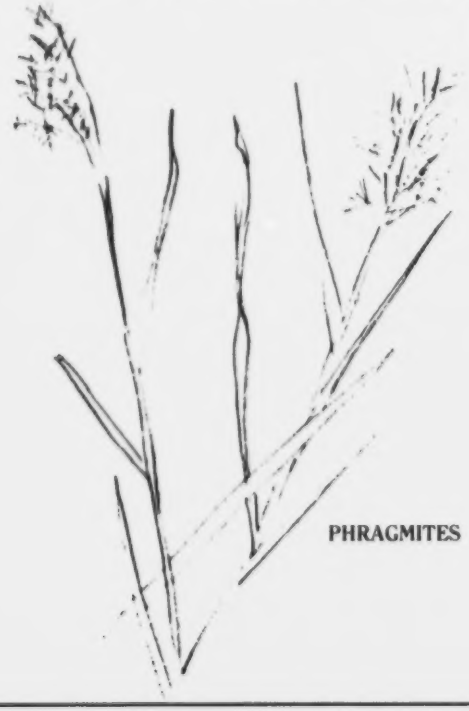
October is a month that brings many observable changes to the community. The greens of late summer will be replaced by the bright hues of autumn. Perhaps the first frost will occur during the month.

The cool, crisp mornings of October are an ideal time for an outdoor walk with your pupils. They (and you) will return from your excursion with a rosy bloom on their cheeks.

Even the "smells" of autumn are different. When you go outdoors, take a deep breath and "sniff," being conscious of the odors. Perhaps the children can use some adjectives to describe these smells.

Here are some activities you can engage in with your class at this time of year:

1. Continue to keep records of the temperature (in older grades). Make a line or bar graph of the temperature as October passes. The downward trend should be apparent. For younger grades, have the children count the days they wore light jackets or sweaters and note when they had to wear winter jackets. Observe and note when heat is turned on in the school building and in the home. Was the heat just on for the morning or all day? Put the information on a large calendar.



PHRAGMITES

2. If phragmites grass (the tall ones with the plumy tops) grows in your area, it makes an interesting study. It grows in wet, disturbed places. Cut one for each 2 or 3 students and have them take it apart. Note the hollow stems, the blades of the leaves attached at its base and telescoping one inside the other, and enclosed by the sheath below it (a common attribute of all grasses). Look at the waving seed head. Grasses are important food sources for people and animals. A few stalks of phragmites standing in a large container will make a beautiful room decoration.

3. Leaf Colors—Drought or other weather conditions may alter the date and intensity of colors from year to year and from place to place. Encourage children to bring some brightly colored leaves from trees in their yards, or from trips to the country. You can supplement these with some you gather from an area near the school. This multiple approach is suggested so that the *variety* of kinds and colors may be observed. Leaves should be pressed between layers of newspaper, weighted down, for a few days. They may then be used in a variety of art projects.

a) If you put them in a waxed paper "sandwich," and then iron (medium/no steam setting), peel the waxed paper off, the wax will remain on the leaves and can be used, as is, to decorate windows, etc. Coated with wax, they should last a long time and retain their color.

b) You can arrange several kinds of leaves between larger sheets of waxed paper, iron, and the sheets will stick together. These can be mounted, in paper frames, and hung as mobiles or on a window. These can also be mounted on colored construction paper as a place mat. A more durable (but expensive) place mat utilizes clear Contact paper, with leaves and dried flowers that have also been pressed under it. Be sure the moisture has been absorbed by pressing before mounting.

c) Their shapes may suggest creatures or objects—real or imaginary.

4. Make bird feeders in preparation for feeding birds

during the winter months. Try to create the feeders from items normally discarded—e.g., milk cartons, plastic bottles, mesh bags, etc. Recycling is thus encouraged. Consider and discuss bird migration. Why do certain species leave for warmer climates while others remain north all year? What are the dangers that exist for both groups? Is there a common denominator among the remaining birds?

Reminder: If you and your class decide to feed the birds, it becomes a commitment because many birds will become dependent on your feeder and will starve if you neglect to feed them.

5. Many herbaceous (non-woody) plants will die as the weather gets colder. This will make many other things more visible on your outdoor excursions. If you were out with your class earlier, you might observe the changes that have taken place. What can they see now that they were unable to see when the growth was heavy?

6. Many plants are releasing their seeds at this time of year, particularly those that are windborne. Find a milkweed pod that is ready to open (or any full seeded pod or head). You might have the children *count* the seeds from a single plant or pod and calculate how many new plants might grow if all the seeds germinated and grew. Why don't they?

7. Look for sweet gum seed pods. The tree, with its star-shaped leaves, drops the prickly "sticky" balls. As the ball dries, its holes open and the seeds fall out. These seeds are another food source for birds and small mammals. Other tree seeds, such as acorns or evergreen cones, may also be found. Shake an open pine cone to find its seeds within the folds.

8. The end of October brings Halloween and its "harvesty" symbols—the pumpkins, Indian corn, gourds. You could have a pumpkin decorating contest and make an artistic harvest display in your room. Pumpkin seeds are delicious roasted. If children cut out Jack-O'-Lanterns, don't throw away the seeds. Separate them from the pulp, dry and toast in a 300° oven and salt to taste. Or put them in your bird feeder, or scatter them in the woods for our animal residents.

To encourage the idea of recycling and utilizing the Jack-O'-Lantern, consider baking pumpkin bread with your class. Enlist the aid of parents. This activity will take an entire afternoon, or part of a morning. Have volunteers bring in ingredients and equipment. You'll have to prepare the pumpkin at home and bring it in.

You'll need the following:

- pot holders
- loaf pans (6-8)
- large mixing bowls (6)
- mixing spoons (3)
- sifters (3)
- measuring cups (3)
- pot scrapers or rubber spatulas (3)

Divide your class into 3 groups, each with a parent supervising. Write the recipe on the board and let 'em do it! If this is done in the afternoon, you won't be able to sample until the next day, since it will be too hot. You may want to use a morning so that it can be eaten in the afternoon. It's especially delicious when spread with soft cream cheese!

Mix 2/3 cup vegetable oil with 2-2/3 cups sugar. Add 4 eggs, 2 cups pumpkin puree (see instructions below) and 2/3 cup water.

Sift together 2 cups whole wheat flour, 1-1/3 cups white flour, 1/2 teaspoon baking powder, 2 teaspoons baking soda, 1-1/4 teaspoons salt, 1 teaspoon cinnamon, and 1 teaspoon ground cloves.

Add dry ingredients to liquid.

Optional: 1 cup raisins, 1-1/2 cups chopped walnuts. (For classroom, I usually make 1 with raisins, 1 with walnuts, 2 with both, 2 without any to accommodate picky eaters).

Pour into 2 or 3 loaf pans and bake at 375° for about 45 minutes to 1 hour, until skewer inserted comes out clean.

Pumpkin puree: Scoop out seeds and stringy tissue. Peel rind. Cut into pieces. Boil or steam until soft. Mash, or put into food processor until smooth. Refrigerate until ready for use.

Pumpkin was a very important food introduced to the white settlers by the Indians.

9. If it's too cold to go out, look closely at the stones and rocks used inside and outside the school building. Some decorative marble may contain fossils. Try to have your pupils locate them. Try water fountains, school lobbies, entrances, particularly older school buildings. A good question to get young minds working. . . how did fossils of sea animals, shellfish, get into land rocks? Perhaps they could track down where the stone originated.

10. No matter what the month, older pupils (4th to 12th) should become aware of environmental issues and problems. Some may be encouraged to keep an ongoing file or scrapbook of newspaper and/or magazine articles dealing with these problems. This would include local as well as national or international news.

11. Television has some excellent programs dealing with natural science. Noteworthy are: National Geographic, NOVA, Cousteau, 3-2-1 Contact, etc. Recommend these to your pupils. You could assign them for viewing and discuss them in class the next day. If your school has a VCR, tape some for class viewing.

We owe it to our students to make them more sensitive so that they will become protective of the environment as they mature.

November

"It is not enough to take people out of doors. We must also teach them to enjoy it."

—Ernest Thompson Seton

November

November brings cold weather, windy days, frosty nights, and gray skies. How do the living things react to this chilling? Much of the world of nature begins a period of dormancy. For some plants, it brings death, but they have left behind them the seeds of new life to germinate when spring returns. Insects, too, disappear, migrating, dying, entering other phases of their life cycle, to winter over as eggs, in cocoons or other pupal stages.

The first snowfall might occur in the North in November (see #8 below). Your exhaled breath may be visible on those crisp mornings. Frost may cover your windows or windshields. Look closely. Are all frosts the same? Why do some form those icy pictures?

Many of the trees are bare, but bare trees have their own subtle beauty, too. Perhaps you or your pupils might wish to capture the beauty with drawings or photographs. Sometimes we are treated to a true "Indian summer" day in November, when the temperature rises into the 70's and teases us, before the final plunge into the reality of a northern winter season.

Here are some activities you can do with your children during November:

1. After the leaves have fallen from the trees, it is interesting to examine the remaining end twigs carefully. Look at the buds. When did they start forming? What is a bud anyway? In preparation for later lessons on buds and twigs, you can begin collecting some. (Note: Do not cut any twigs from trees without permission of the owner of the property). In our *December* hints, we will take a closer look at twigs and buds. Use this time to point them out to the children and start your own collection from various places.

2. Talking about leaves having fallen from trees, *why* do they fall anyway? How has this adaptive process benefited the deciduous trees of the northern latitudes and insured their survival? In nature, nothing persists without a survival benefit for the species. The trees, by losing their leaves, protect themselves from death by water loss through their leaves. Let's backtrack a bit: A tree takes in water through its roots and sends the water through its branches to its leaves to be used for photosynthesis (making of food). The flat leaves of the deciduous trees (non-evergreens) give off many gallons of water every day, which evaporate into the air (transpiration). As the weather gets colder, the tree prepares for the coming winter by developing a tough cuticle at the place where the leaf meets the twig. Thus, a seal is formed. The leaf loses its own source of water, dies and falls off, thereby also cutting off the loss of water through the leaves. A close look at twigs (see #1) will also reveal a "scar," where the leaf had been attached to the twig.

3. Still talking about leaves, look at leaves on the ground. Whatever happened to their lovely colors of yellow, red and orange? Now they all seem to be brown and dry or non-descript black-brown, if they are wet. Crumble some dry ones in your hand. They fall apart so easily. If you used untreated leaves as room decorations, they've lost their color and their texture. If you did the "waxing treatment" (see *October*, #3A), it might be a good idea to compare the appearance and texture of the treated leaves with those left alone. Here's a chance to see how just one variable, the wax, affects the leaves. We will pick up this idea and use it for a good winter activity. (Don't throw those dead leaves in the garbage—they are good organic material. Save them for a compost pile-to-be!)

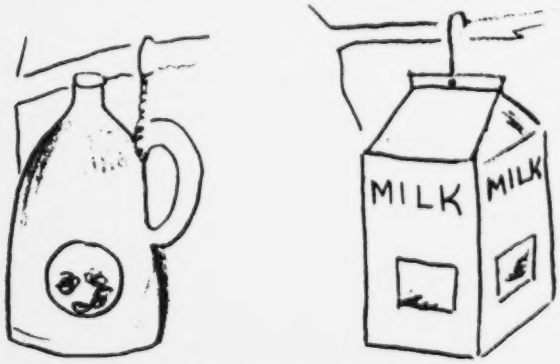
4. Leaves on the ground neatly tie in with another good activity/observation. November weekends bring leaf-raking chores to many lawn keepers. But what happens to leaves that have fallen in a natural area? No one rakes them up. Nature is a great recycler and when a plant or animal dies, as it decomposes (breaks down), it supports other life that will come after it. So crouch down and look closely at the leaf litter scattered on the floor of a forest. This year's leaves are on top. Gently move them aside and try to find last year's leaves. How can you tell they are last year's? In what ways do they look different? Color, size of pieces, wetness? Keep doing that, scraping aside, looking, until you have reached a point where the leaves no longer resemble leaves anymore. What are they now? How many years back do they go? How long did it take?—count backwards. What else did you find mixed in with the leaf litter? Try to create a mental image of the appearance of the forest floor. We will study the soil in greater detail in the Spring months.

5. In your Social Studies lesson, as you discuss the Pilgrims, Indians or our colonial ancestors, give some thought and time to a discussion of how *they* prepared

for the coming of the winter. For our forefathers, the changing seasons brought more drastic changes to their lives. Their very survival might depend on what measures they took during late autumn to prepare, like their animal relatives, for the fierce onslaught of winter. For us, and our modern technology, the changes are not so drastic. Trucks and planes bring us fresh foods from warm climates; canned and frozen foods stay indefinitely and know no season. We turn on the furnace and get out the warmer clothes. But for our ancestors (and even today, for people in less developed areas), food harvest and storage, as well as laying in a supply of food, are crucial.

Wild food, gathered by the Indians and others, was a very important part of their diet. The Pilgrims could not have survived without wild nuts, berries, roots, etc., because they arrived in the New World too late to plant their crops.

Are there any wild, edible foods growing in areas near your school? There may be chicory, to start, and probably dandelion greens. Perhaps you and your class could inventory the plants and find out, using various source books, which plants are edible (see Bibliography). Even acorns were ground into a flour for consumption.



6. Now is the time to set up your bird feeders. If you didn't make some earlier, make them now. Keep them simple. Use "found" materials. It's cheaper and easier. Moreover, it is ecologically sound and good educational practice to show children how to recycle items they would normally discard. Some examples are: a large plastic bleach bottle (very well washed) or gallon milk jug, a 1/2-gallon size milk container, a plastic mesh onion or orange bag. Even a pine cone with open scales can be easily stuffed with peanut butter, rolled in bird seed and hung from a tree.

What to feed the birds—Purchased wild bird seed, bread crumbs made from dry, old bread, peanut butter, suet (meat fat) obtained from a butcher, etc.

Where to put the feeder—You could experiment by placing it on a classroom outer window. It might attract some birds, but chances are that birds will not venture far from protective cover. Try anyway. Or you could hang it from a tree that is visible from your classroom window and keep a pair of binoculars on a shelf. Get a single copy of a bird identification book and leave it next to the binoculars. The children could keep a record of whatever birds they see (date seen, time, etc.).

A good alternative is that each pupil makes his or her own feeder and takes it home, placing it in a suitable location, near trees and/or other cover. This way, each pupil can make his/her own observations as to which birds come to feed. Besides, birds feed early in the day, and they can watch them before school starts. They could keep their own lists at home, pool them on one day. (Reminder: Once you start to feed the birds, you must continue—see *October*, #4.) Some winter birds you might see at your feeder are chickadees, tree and house sparrows, starlings, bluejays (listen for their distinctive call), finches, and, if you're lucky, perhaps the feeder will attract a cardinal or two.

Incidentally, as the song says, listen for the mockingbird (perhaps a pair). You can recognize the bird by its intricate and varied songs, very beautiful with many different melodies. Look for the long, fan-shaped tail, white markings on the underwings. On a warm day, you may even see the male "displaying"—jumping a few feet off his perch, opening his wings, and alighting again. Mockingbirds do not migrate, and they are making a strong comeback in urban and suburban areas.

7. Apples are in season! They are plentiful in the produce stores. Some nearby farms and orchards promote family and group apple-picking. (It makes a good class trip to consider.) Apples are abundant and interesting to study. What is a fruit anyway? What part of the tree produced it? What adaptative purpose does its

delicious flesh serve? How are its seeds dispersed? Cut an apple in half across its center; examine the placement of the seeds; see the star within. Why are the seeds encased in a thick cuticle? Plant a few seeds. Did they germinate? Put a few in the refrigerator and then plant in the spring. Do they germinate as well or better? With luck, you might have your very own apple tree seedling, ready to be transplanted when of suitable size.

How many different *varieties* of apples are there? Bring one of each to class. Discuss how the different varieties are bred (older children). No apple lesson should end without *tasting*! Perhaps you can prepare applesauce with your students.

Consider the apple in literature—golden apples, poison apples, even New York City is the Big Apple!

Possibilities for investigation are only limited by time and other work pressures.

8. If the first snowfall occurs in November, it may be an opportune time to actually see with your own eyes (and show your pupils) the 6-pointed crystal configuration of snowflakes. The first snowfall is generally a light dusting, and it is this kind of snowfall that lends itself to viewing because the flakes are dry and do not cling to each other. To see the flakes, go out with a piece of dark or black construction paper. Catch the snowflakes and look at them. A hand lens (one for each child) will make their beauty even more apparent. Unfortunately, like so many beautiful experiences, they melt and their beauty disappears, but the mental image remains. Preserving them for any great length of time requires more preparation. You have to use black (or dark) cloth, which has been put in the freezer prior to the activity.

In the *January* section, I will give you detailed instructions on creating 6-sided paper snowflakes. Perhaps one of your pupils would like to research why and how water vapor freezes into such lovely crystalline forms. More about snow will follow in later chapters.

Each month and season has its own beauty, if we know where to look for it.

December

"If you think ahead 1 year,
plant a seed.

If you think ahead 10 years,
plant a tree.

If you think ahead 100 years,
educate the people."

—Kuan-Tsu, 3rd Century B.C.

December

There's no mistaking the season now—winter is here. The shadows are long before the end of the school day, as the sun's rays continue to shine more obliquely. The air seems to crackle; if you are properly dressed for the weather, you will feel invigorated by it. Remember, the temperate latitudes, with their wide swings of weather and climate, are the sites of the most highly developed civilizations; and the climate certainly plays more than a coincidential part.

But what changes have come about in the out of doors around school, as the year comes to a close? Let's not be afraid to go out, even if it is winter. Make sure your pupils are dressed in appropriate winter gear, and try to pick a day that the wind doesn't blow too much. Remember, wind makes it feel colder.

1. December brings the winter solstice between the 20th and 22nd. On that day, the sun is at its southernmost point, just above the Tropic of Capricorn. We have the shortest day and longest night in the northern hemisphere and the North Pole has 24 hours of darkness. If your pupils have been making sunrise/sunset observations (see *September*, #1), don't stop now because the entire process will slowly begin to reverse at this point in time. Ancient peoples feared the loss of the sun, and rejoiced at its return. We can trace many of our holiday traditions to the winter solstice rituals. (You might tie this in with Social Studies, Literature, Music, as you discuss holiday celebrations and symbols.) If you take your class out, especially if it's after 2 p.m., notice the long shadows. Perhaps your pupils can (quickly) trace each other's shadows on large sheets of paper, date them, and repeat in the spring (same hour of the day).

2. One of our most endearing (and enduring) holiday symbols is the Christmas tree. The tree is usually an evergreen tree, generally a spruce or fir.

December, then, is a good occasion to examine evergreens closely and find out why they remain green all year. You're sure to find evergreens either on the school property or nearby. (If they are within a locked area, you'll have to set up a time with the custodian, so he can open it for you.) Last month (*November*, #2), we investigated deciduous trees and concluded that the reason they lost their leaves was to protect themselves from dying via water loss. If we compare the deciduous and evergreen trees, we can observe one striking difference—the leaves of the evergreens are *needles* (or scales) and do *not* expose a large, flat surface to the air. In addition, the needles are covered with a waxy coating. Transpiration through the needles is considerably less than in deciduous trees.

HEMLOCK

SCOTCH PINE

Be sure to observe that some of the evergreens have *long* needles (the pines), and some *short* (hemlock, spruce). Point this difference out to the children because some of them think all evergreens are pines.

Pull out the pine needles; note that they may be in bundles of two, three or five within a sheath. On the shorter needles, scrape the edge to see if a wax comes off. Have pupils bring in additional specimens from other trees. Be sure to crush the leaves to release the lovely odor.

Evergreens remain "ever green" because they can retain water in their "food factories" (leaves). The farther north you go, or the higher up a mountain, the greater the proportion of evergreens to deciduous trees.

3. As the holiday season approaches, it might be fun to prepare a winter feast for the birds and other wildlife and put it on a tree. Have the children string popcorn, peanuts (in their shells), whole cranberries, to be hung as garlands around an outdoor tree. They can put thread through the holes in a cracker, make a loop, spread peanut butter on one, or both sides of the cracker, press the peanut butter into bird seed, and hang them on branches. They may be rewarded by glimpses of wild

creatures who come to feed at their thoughtful holiday present. This could be done as a class project or individuals might want to do it on their trees at home.

Before the children recess for the holidays, remind them to think about wildlife when they are ready to discard their *live* trees after the holidays are over. Perhaps you can set up a day, early in January, to receive discarded live trees, which have had all their tinsel and other decorations removed, to be recycled as wildlife habitat in a wooded areas. Or, if they prefer, they can put the tree into a wooded area closer to their own homes. Many birds and small mammals will utilize the trees for cover, and the children will have the satisfaction of knowing they have helped wildlife. If your only "wild" area is a vacant lot, this, of course, would attract the wrong kinds of mammals and is not suggested.

4. Birds again! We might take time to discuss which birds fly South for the winter and which stay by investigating *why* they migrate. In #5, we will talk about how birds keep from freezing. It is the *availability of the food* eaten by the bird that determines whether it remains or leaves. Thus, looking at a bird's beak, which is an indication of its food preference, will tell us whether or not it migrates. Examples:

a) a *sparrow* has a short, stout beak, that enables it to eat seeds, which are available in the winter. Therefore, it stays.

b) a *warbler*, with its small beak, catches insects in flight. Flying insects are not available in the winter. Therefore, it leaves.

c) a flat-billed *duck* eats water plants in ponds and lakes which freeze over in the winter. Therefore, they leave. Some do remain on various ponds but they can sometimes starve during extended periods of below freezing temperature.

Consult the next page of illustrations for further examples.

Have your pupils try to observe the beaks of the winter birds to confirm this. They can also find pictures of birds in books, look at the beaks, and try to decide if they stay or go.

5. How do birds and other animals keep from freezing during the winter? Observe the birds where they are perching. Birds have many built-in adaptations which keep them from freezing. First of all, they are warm-blooded, and many have temperatures over 100°F. Second, they possess glands which secrete an oil; as the bird preens, it spreads the oil on its feathers, creating a waterproofing. Perhaps some of your pupils use saddle soap or some other substance to create a water barrier on their shoes. If you have ever been caught outdoors in a cold, wet rain that soaks through, you will understand the importance of preventing this. Of course, I wouldn't recommend trying that with your pupils, but you might talk about or try it using non-waterproof gloves.

And, of course, a bird wears its own down winter jacket. Since down jackets and vests are very much *in*, they are readily available to be looked at, thought about and discussed. This can be your means of teaching about birds, their ability to survive, and man's copying (and taking) from animals in order to make his own life easier. Early man (and later woman!, and even later man again!) covered himself with the furs of animals to keep warm. But what is it about *down* that helps it keep us and the birds warm? *Down* is the very soft fluffy feathers that cover a baby bird all over and adult birds in specific places. Down feathers are not intended for flying; they are much too weak for that. But their fluffiness traps the air in and thereby creates a great insulator. Body heat is retained; cold air remains outside.

Have a pupil look closely at his or her down jacket. In order for it to be effective, it must be fluffy. That is why the jackets are so puffy. The stitches (quilting) keep the down in each section separate, so that they do not mat together and flatten. If a jacket develops a hole or tear, then you will have an opportunity to examine the bits of fluffy down. (Don't make a hole in anyone's jacket, of course! Ask the kids. Someone's might be slightly torn, and everyone could look at that one.) Some sleeping bags made of down are effective at temperatures below 0°F.

Now look at birds again. Notice how "chubby" they look perched on wires and eaves. It's just fluffed up down doing its job for its "inventor." We will look at other animals' winter survival techniques in the *January* or *February* chapter.

See illustration on following page

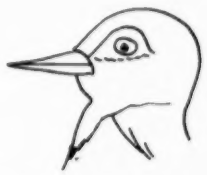
December

These birds can *stay* because they can find food during the winter.

SPARROW CARDINAL GROSBEAK

FAT BEAKS—seed eaters; can crack seeds

WOODPECKER



DRILLING BEAK—
can find food where it hides

PIGEON CROW

GENERAL BEAK—eat anything

HAWK VULTURE
(scavenger)

SHARP BEAK—FLESH EATERS—
eat small mammals that stay

These birds must *migrate* because they cannot find their food in winter.

DUCK or GOOSE

FLAT BILL—
ponds freeze;
no food available

KINGFISHER

HERON

FISH EATERS—ponds freeze;
no food available

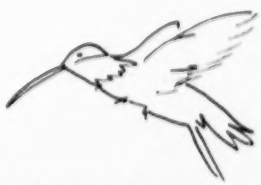
WOODCOCK

SNAIL EATER—
eats snails from muddy
ground; ground freezes

WARBLER

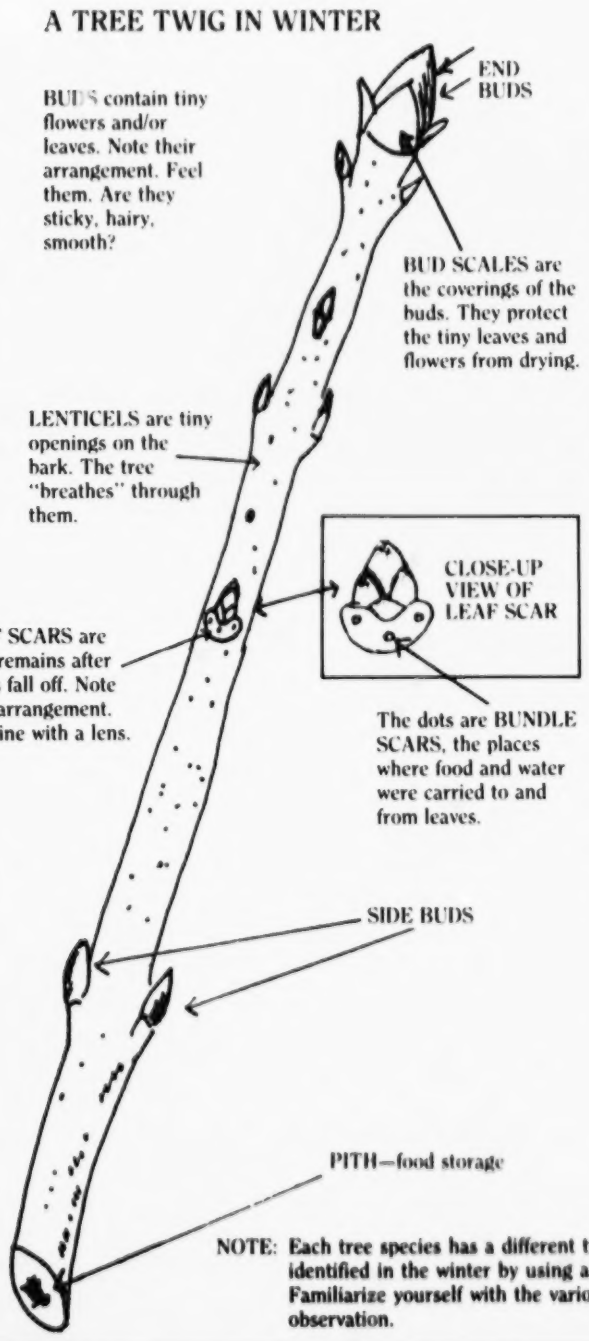
SHARP BEAK—
flying insect eater;
no flying insects

HUMMINGBIRD



LONG DRINKING TUBE—
drinks flower nectar;
no flowers

(Adapted from a Lesson by Brian Ruffe)


A TREE TWIG IN WINTER
END BUDS
BUDS contain tiny flowers and/or leaves. Note their arrangement. Feel them. Are they sticky, hairy, smooth?
BUD SCALES are the coverings of the buds. They protect the tiny leaves and flowers from drying.
LENTICELS are tiny openings on the bark. The tree "breathes" through them.
CLOSE-UP VIEW OF LEAF SCAR
LEAF SCARS are what remains after leaves fall off. Note their arrangement. Examine with a lens.
The dots are BUNDLE SCARS, the places where food and water were carried to and from leaves.
SIDE BUDS
PITH—food storage
NOTE: Each tree species has a different twig. Trees may be identified in the winter by using a twig key. Familiarize yourself with the various kinds by close observation.

6. Last month, we touched briefly on *twigs*, and it was suggested you look carefully at several different kinds and try to collect a variety for closer examination. Studying twigs tells us a great deal of information about trees, and how they function. Study the accompanying diagram, and using a real twig, try to locate the various parts on your own twig. You will need a lens to see some parts clearly.

If you have enough twigs to go around, hand them out to your pupils, 3rd grade and up. (Wait a bit before handing them lenses, so they will focus on large details first). Have them draw the twig the best they can. This forces them to look closely as they attempt to capture the details. Lenses can be given out at this point, to help them refine their drawings. They can draw the details the lens permitted them to see. If you copy the drawing (from this page—or your own) on the board, you can use accompanying data to explain the function of each of the parts they have observed. Your students may be able to carefully open some of the buds to see the tiny leaves and/or other parts. Or, you could place some in water, and they may open by themselves in a few days. If they do open, your pupils may then understand how the availability of water in *its liquid* (not frozen) *state* in the early spring thaw causes the buds to swell, as the water is taken in, and the trees bloom. It is the reverse of the process described in *November*, #2, one more example of how natural systems adapt to changing conditions of the environment.

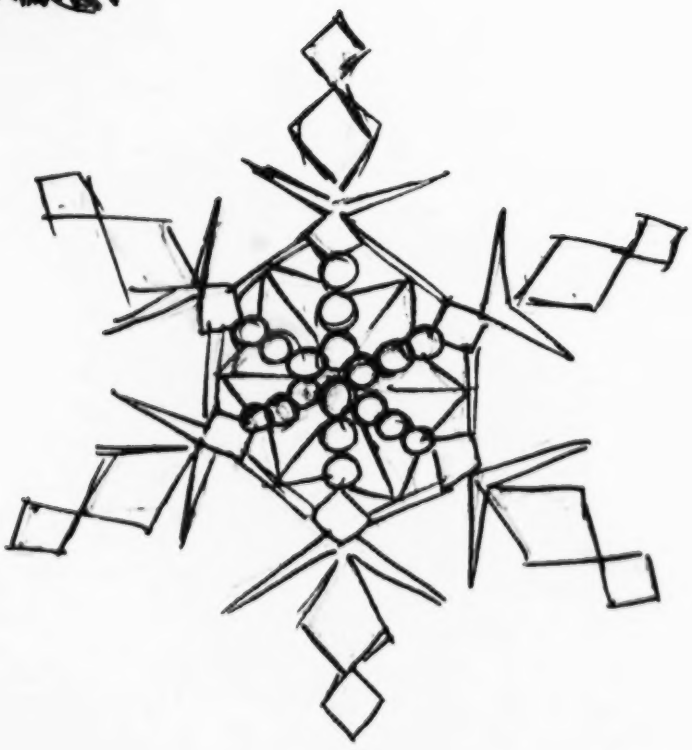
More sophisticated students might be interested in learning to identify trees via their winter twigs! (See Bibliography for a twig key.)

Escape the classroom doldrums. Take a walk outdoors on a bright, though cold, December day.

January

"Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web he does to himself."

—Chief Seattle, 1854



January

The hoary breath of winter is full upon us. Some of us dread the onslaught and flee (or would like to) to warmer places (the Sunbelt grows). Others merely tolerate it, waiting out the winter from within warm walls, until it spends itself, before moving on to better things. There are those, however, who welcome the snap of a winter day. They do not dread the snowfall, but cheer it.

Children, for the most part, fall into the last category. To them, winter means snowballs, snowmen, sledding, and other wintry pleasures. No amount of adult squelching can subdue the squeals of delight when your pupils see the snow falling. Don't fight it; join it!

If you dislike the winter, do not impose this on your children. In an era when we go from heated home to heated car to heated schools, stores, and offices, is it any wonder why our bodies cannot adapt to the cold? We are not used to it.

Let's begin our *January* chapter then with a discussion of snow and its companion, ice.

1. *SNOW*. As water vapor (the gaseous state of water) passes through layers of air that are below freezing, it (the VAPOR) freezes. As it freezes, it takes on the beautiful 6-sided crystalline structure. It's true, no two snowflakes are exactly alike. Sometimes, the 6-sided configuration is not visible, as the snow may be too wet and clump. But on those occasions, when the structure is visible, try to grab the moment with your pupils. Use dark-colored construction paper, or cloth, or cloth stapled to cardboard (buy a remnant). Be sure to get the "snow catchers" cold first, so the snowflakes don't melt on contact. Put them out on the windowsill with the window holding them down so they don't blow away. Lenses are needed, too, since the beauty of snowflakes is small, and not readily visible to the naked eye.

Be observant, be patient. You will be rewarded by a glimpse of exquisite natural beauty. If you have clear lacquer (or even try hair spray), chill a piece of glass, catch snowflakes and try to spray them to preserve them.

A good time for this activity would be just before lunch or at 2:45. I think it would be asking a bit too much of a child to suppress his exuberance. Remember, the study of nature should be enjoyable. By going out just before dismissal, your pupils will be dressed in their outerwear, and after they have looked at the snowflakes, you can collect the lenses, snow catchers and just dismiss the class.

2. A snowflake is a 6-sided crystal. Cutting out snowflakes is a great art activity. It can also be a math activity, especially for gifted children, to figure out the exact angles, measure and draw them. Instructions for cutting follow. Use white rexo or mimeo paper. White paper napkins are also very easy to cut and are pre-folded in quarters; they are large, however.

a) You should start with a *square*. If you are using 8½" x 11" paper, square it off by folding a corner and cutting off the excess. (Fig. 1)

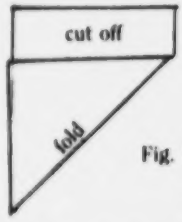


Fig. 1

b) Open out. Fold the remaining square in half, and then in half again. (Figs. 2 and 3)

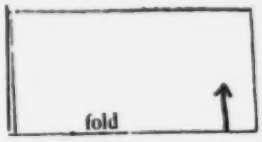


Fig. 2

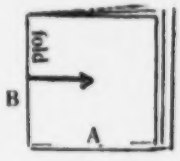


Fig. 3

c) Fold folded edge A up, as shown in Fig. 4. The triangle formed should be ½ the size of the remaining portion.

Fig. 4

d) Then fold side B down over to meet fold C. It should be in even thirds. (Fig. 5)

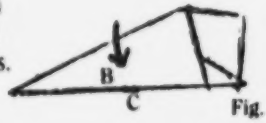


Fig. 5

e) Cut off top in a jagged line. Vary the angle of the cuts for different kinds of snowflakes. (Fig. 6)

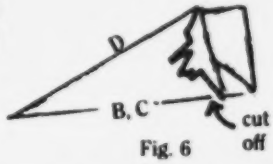


Fig. 6

f) Make jagged cuts on both folds D and B/C. (Fig. 7)

Fig. 7

Open carefully. Snowflakes should be 6-sided. There are two basic types of snow crystals, the hexagonal (Fig. 8) and the stellar, or star-shaped (Fig. 9). Both can be

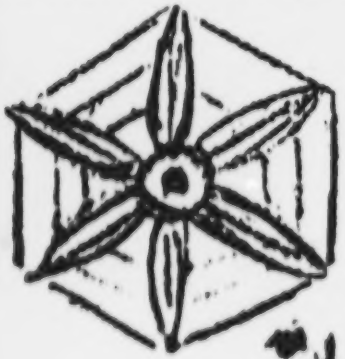


Fig. 8

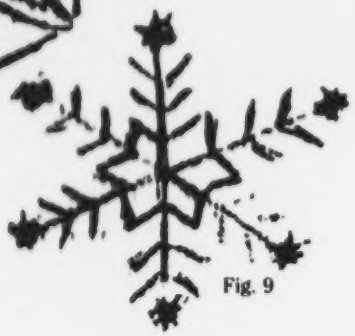


Fig. 9

achieved by cutting the paper less or more angular. Experiment by yourself before trying it with the class; it can be tricky. The most important part is step d, to try to get the 3 parts *even* with each other. Children might like to do them at home, using paper napkins.

Or try with brightly colored tissue paper for a hued snowflake. The tissue paper is also very light, and children might want to "float" their snowflakes from a height.

3. During a snowfall or soon after are especially lovely times out of doors. Such moments lend themselves to artistic, poetic, and literary expression. This might be an opportune time for you to try Winter *haiku* with your pupils. Haiku is a simple form of poetry, created by the Japanese, and almost invariably dealing with nature. It consists of 3 lines. The first line consists of 5 syllables, the 2nd line has 7 syllables, and the 3rd line has 5 syllables.

Example: The snow falls softly
Covering the earth and trees
Whiteness all around.

The *cinquain* is another suitable poetic form. It consists of 5 lines, with 2, 4, 6, 8 and 2 syllables. Its format is more structured:

Line 1 - title
Line 2 - description of the title
Line 3 - description of action
Line 4 - description of feeling
Line 5 - another word for the title.

Example: Snowfall,
White and fluffy
Falling, swirling, blowing
Ice cold, brushing against my cheeks.
Crystals.

Chalk on black paper is a very effective way to depict snow scenes. The finished pictures may be sprayed with clear lacquer. Cotton may also be used for a 3-dimensional effect.

It would be hoped that the class would go out of doors for their artistic inspiration. Aesthetic impressions should be experienced directly. Suggestion: Why not utilize one of your gym periods to go into the woods? Then the class could come indoors, with images still in their minds' eyes to write the poems. Another alternative might be to arrange to meet your class in the lunchroom at the end of the lunch period and take them out then. This way, they would be dressed for the outdoors (be sure they have their boots before lunch that day).

For what is basically an excursion outdoors to experience the *beauty* of the season, it is vital that both pupils and teachers limit their speaking while they are outside. The out of doors has a special hushed quality about it that is intrinsic; resist the temptation to look at other things. Save that for another time. Just stand still, look slowly around, and listen. Prepare the children beforehand so they will know what is expected of them; use hand signals.

Perhaps you could discuss, later that day, the things they observed. Someone might even wish to investigate *why* the sharpness of sounds does disappear during and after a snowfall.

4. Another way to view trees, be it artistically or scientifically, is from a distance (i.e., from a classroom or hall window). In the winter, leaves are no clue, so for identification, you must rely on shape and texture (of bark), or twigs. Sometimes, there are subtle colors—purples, yellows, reds—that are not visible close up, but can be seen readily from a distance. Try to remember their outline or general configuration. Use visual mental gimmicks as an aid to help you.

For example:

spade (cards) shape

oval

triangle with point up

triangle with point down etc.

Draw, or quickly sketch it. Try charcoal, or very soft pencil, or crayon. Little by little, you will begin to discern the patterns. This can also be tied in with geometric shapes in math.

5. Years ago, and today in some remote places, snow used to be delicious and safe to eat. Indeed, melted snow was an important source of drinking water for families. Icicles were tasty, too. But today, in most places, I would caution children against eating snow. As it falls, it brings with it the pollutants, chemical and otherwise, that are in the air. (In fact, rain itself is so high in acid content, that many of our once-clean lakes upstate are totally devoid of fish.) Elementary school children could readily do simple experiments that might show relative amounts of particulate (pieces) pollution. They could collect snow (the same amount), using cans or empty milk containers, from various locations, e.g., woods, fields, blacktop, front of school, sill, lawn area, etc. Bring the samples indoors and pour them into containers through filter paper (coffee filters are good). They could examine the residue and compare the particles observed in each sample and draw their own conclusions. CAUTION: Even if a particular sample appears clean, the chemical pollutants are usually not visible, and could not be detected with filter paper. To be safe, discourage children from eating snow.

6. Fourth-to-eighth graders might do some temperature studies of snow. They could measure the temperature at various depths and in different places in the woods, fields, etc. They might try to determine the different rates of melting, using light and dark squares of construction paper. They can observe melting rates on various rooftops. You might even use this occasion to point out why roofs in the Northern latitudes slant (no flat-topped adobe haciendas here!). Actually, snow performs an insulating function for the soil. Animals utilize this property when seeking shelter from the cold (think of the Eskimo in his snow house). Plants, too, benefit from this effect.

This might be a good chance to introduce metric terminology regarding temperature. Neighborhood banks flash the Celsius and Fahrenheit temperatures, one after the other; both are given on the radio and T.V. weather announcements. We have thermometers in school which show F. and C. on the same thermometer. Pupils should be familiar with both systems and be able to use both with ease.

7. This brings us to a consideration of freezing and ice. The way water in nature behaves when it freezes is an interesting and important phenomenon. Since life is so intimately intertwined with water, these manifestations are crucial to life on earth. There are many experiments you can do with water and many observations you can make out of doors that will illustrate these properties.

a) Water expands when it freezes (as opposed to other materials that contract), and ice is therefore lighter than liquid water. As a result, ice *floats* on water. Demonstrate by putting ice cubes in a glass of water. To what degree do they float, however? Think of icebergs—how much is above water, how much below (remember, that's on salt water)? The implications of this phenomenon are tremendous; for example, it is the *surface* of ponds and lakes that freezes. Lower layers remain unfrozen, and this enables aquatic creatures to live on the bottom. A good experiment that illustrates the expansion of water when freezing can be readily accomplished by 3rd through 8th

graders at home. Fill a plastic container with water to overflowing, cover it securely, place in freezer. Examine it the next morning. The cover should be pushed up, the ice now taking up more space than the equivalent amount of water. Point out to your pupils that this expansion is very powerful and can break through thick pipes.

b) Water and land cool at different rates. Watch a pond or large puddle freeze. Does it start to freeze at the edges first and then freeze toward the center, or vice versa? Does the process reverse when it thaws? Why or why not?

c) To what depth does the soil freeze in these latitudes? How deep must our water pipes be buried to avoid being frozen? Perhaps someone's parent works in the building industry and can provide the legal code. Have children notice how icy cold the drinking water is at this time of year. But why does this persist until about early May? (See #7b above.)

d) Why can you see your breath on a cold day ? What is happening to the water vapor your body exhales as it hits the frigid air?

e) Does a moving river or stream ever freeze solid? Have children observe on weekend car excursions and report back to the class if there is no available stream nearby.

f) Other related questions that might be investigated:
Why are so many potholes created during the winter months? (See #7a above.)
Why do people put salt on ice to melt it?
Why do people put anti-freeze in their cars?
What might happen if they didn't?
How does anti-freeze work?
How did the large rocks we see in our parks and in vacant lots get here?

Perhaps in a later chapter, we will talk about the Ice Age.

8. Early in January, consider having a live Christmas tree recycling. Pupils may bring their discarded trees to a specified place at a specified time. *All* tinsel and decorations must be removed. Pile them up in a wooded area where they will provide good cover for birds and small mammals. If the tree cannot be brought to school, encourage your pupils to drag it to the nearest wooded area and put it there for wildlife. This activity can only be done if there is a suitable place for it.

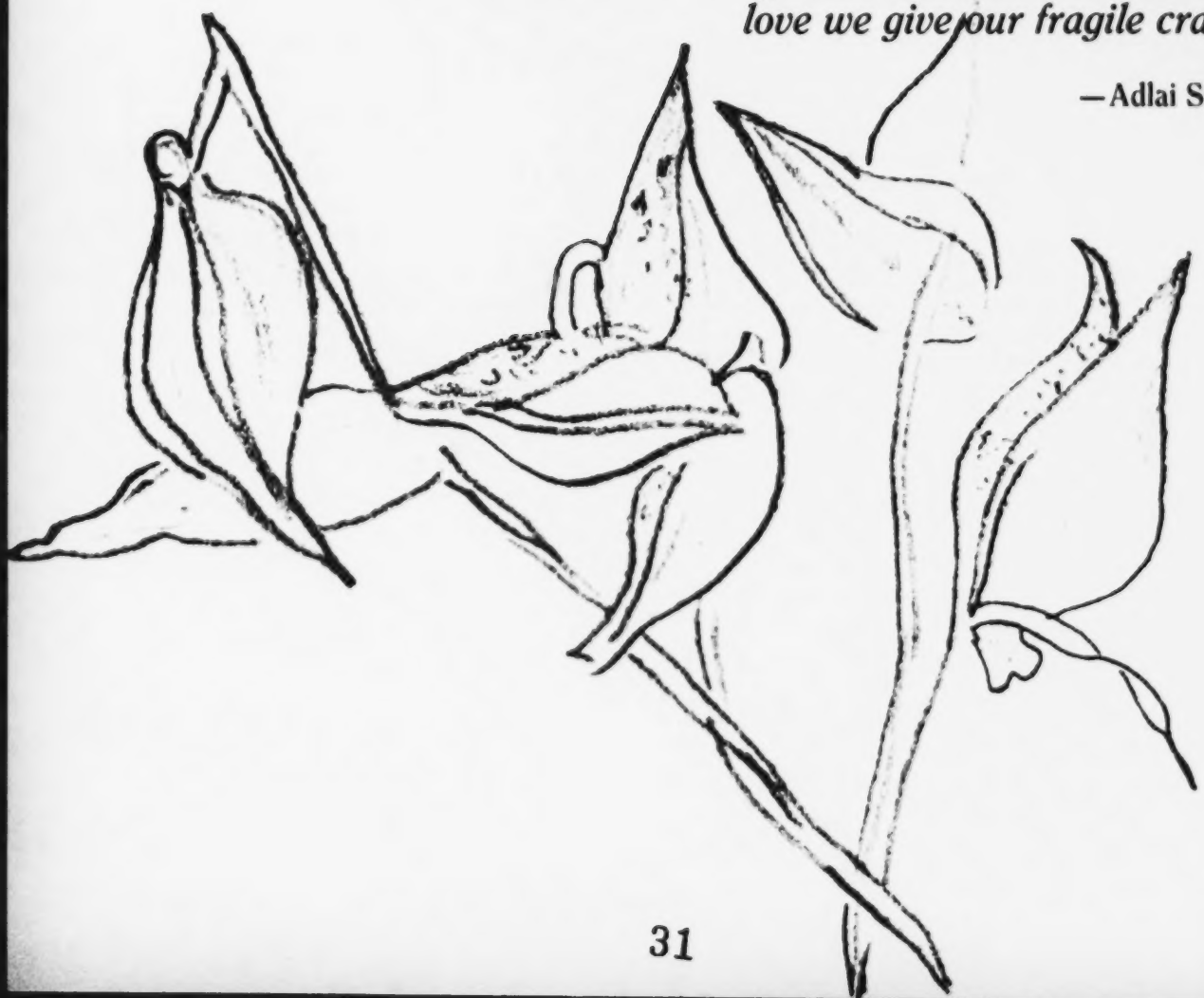
9. With leaves off the trees, and other foliage greatly reduced, nests become more visible. Children can observe and make note of the nests they now see around their homes, or pass on the way to school. (N.B.—Even though most birds build new nests each year, it is illegal to remove them.) By noting carefully now (make a map) which trees have nests, you might want to find out if the birds come back to the same place each year. Also, look for the very leafy, large squirrels' nests, built in the crook of upper branches. The squirrels only use them in the summer; they need more protection in the winter. However, by noting the vacant "apartments" when they are visible, you may be rewarded by seeing their "tenants" when the weather warms up.

The sun has already begun its northern journey; the days are beginning to grow longer again. If we did not have the Winter, perhaps we would not appreciate the Spring as much. Winter is not a "dead" time, just one of dormancy and waiting. There is much to discover, and much life to find.

February

"We travel together, passengers on a little spaceship, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work and the love we give our fragile craft."

—Adlai Stevenson



February

Winter, the ground-hog notwithstanding, is on the wane. The sun is slowly returning to the Northern Hemisphere as the days begin to grow longer, and possibly somewhat warmer. By February's end, in some places, some faint stirrings of the coming Spring may be observed. In wet places, the skunk cabbage will be pushing its way up through the snow.

For most of the plants and animals in your community, however, winter is still very much an apparent fact of life. Since there is a time lag, February is often colder than December, the time of the winter solstice. Let's examine some of the mechanisms by which living things (or their offspring) survive in the Northern latitudes. Pick a nice day, when temperatures rise into the 40's, to go out. Protective footwear might be in order, since melting snow will create mud.

1. Some birds have flown South; some are managing as best as possible to find food, keep warm enough, and survive. Be sure to look upward on your outdoor walk. You certainly will see members of the gull family and perhaps crows and pigeons. If you're lucky, you might catch a glimpse of non-migratory ducks or even geese (they fly in flocks, usually).

2. The wet areas in your community and nearby parkland are home for a variety of amphibians—frogs, toads and salamanders—and reptiles—snakes and turtles.

Since these animals are cold-blooded and take on the temperature of their surroundings, they must find a place that will not freeze during the winter. They burrow in the mud and elsewhere underground to wait out the winter. Stored food in their bodies provides their minimal nutritional needs. With so much dryness, lately, however, many of our amphibians, who are dependent on water, may have gone to wetter places or died. This remains to be seen, as we too await the Spring thaw.

3. Mammals, on the other hand, are warm-blooded and maintain a set body temperature. You may see squirrels, mice or rats. Some areas support muskrats, opossums and/or raccoons. Their presence will vary greatly and depend on the degree of land development.

These mammals do not really hibernate over the winter, but do find protective cover, venturing out now and then to find food. After a fresh snowfall, a visit to a wooded area might allow you to find their tracks. They are not as active as in the warm weather. Many have put on an extra layer of fat and their fur keeps them warm.

4. Insects. Some insects have died, leaving behind their young, developing in egg, larva or pupa stages. Look for cocoons in crevices, under eaves or rocks, on twigs. Some insects burrow underground. Some are *grubs*, which is the stage of an insect that undergoes incomplete metamorphosis. If, by chance, you should find a grub in a piece of rotting wood, you might want to bring it indoors and put it in a screened, covered fishbowl and observe its development. (Keep it cool.) Some insect-eating birds who have not migrated depend on grubs for their subsistence.

Several insect "left-behinds" should be available for scrutiny.

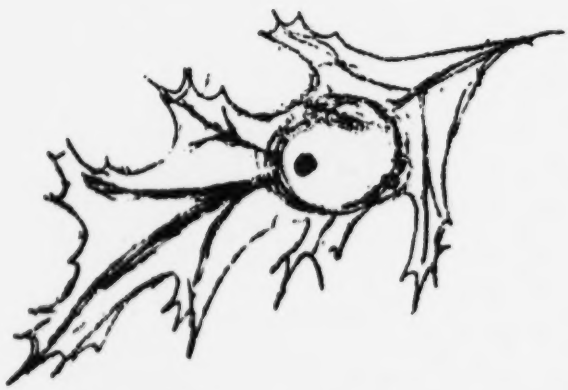
a) In an area of tall dried grasses, find praying mantis egg cases. The adult female deposited the foamy mass on plant stalks just before she died in late fall. These masses, now firm, may be found about halfway up the stems of supporting weeds. A possible subject for research inquiry: Why don't these tiny creatures, developing in their protective cases, freeze (or dry out) during the winter?

A word of advice: Do not bring the case-bearing stems indoors. They will respond to the warmth

within your classroom and may hatch prematurely. Since they are carnivores and eat other insects, they will have nothing to eat until late Spring and will perish (in the interim, eating each other). Leave them out until they hatch naturally; they are a great boon to gardeners since they will devour many harmful insects—a great alternative solution to the more dangerous insecticides. They do, however, eat butterflies and to butterfly lovers, the mantids are the pest insects.

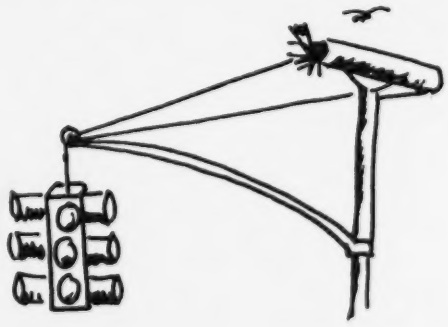
b) Another visible insect home, seen more readily in the winter when trees are bare, is that of the *bagworm*. The bagworms are insects with an unusual life history and interesting home decor. The *bag* is made of body silk, decorated with plant material. Within, lives a larva, then a pupa. Only the male ever emerges from the bag; the female remains within the bag, even laying eggs and dying within. You might find just one to pick and bring indoors to observe. The bag may be found suspended from the branches of common street trees. They are well camouflaged and look like part of the tree.

c) Yet another kind of insect "home" that may be seen readily at this time of year are *galls*. Galls are growths on plants that result when certain insects lay their eggs on parts of plants. The plant, stimulated perhaps by chemical action of the egg, creates a protective wall of tissue. Within the gall, the egg hatches, and the larva feeds, away from predators and nourished by the host plant. When ready, the insect makes an opening in the gall and emerges, often as a winged adult. Galls take a variety of forms.



Some are swellings on leaves or stems; others are on the vein margins. Each one is caused by a different insect and is specific to that insect and its plant host. Oak trees have several kinds of galls. Look for them; see if they are empty or still inhabited. Check the ground near the oak trees. Gall keys are available (see Bibliography). Many galls, however, only appear in Spring or Summer.

5. February is not too early to begin looking for signs of nest-building by birds. In last month's guide (*January*, #9), we talked about old nests being more visible when trees are bare. It may be necessary to look carefully, because some old nests, particularly after the ravages of Winter, barely resemble picture-book birds' nests. Birds, especially those living in close proximity to people, frequently incorporate a variety of man-made material into their nests, such as plastic strips, cord and stockings. So, take a second look at that "stuff" hanging from the branch; it may be an old bird's nest.



February

Some species will be beginning their search for sites and readying their quarters for egg-laying. Be alert to increased activity as February draws to a close.

Popular choices for our urban sparrows are the horizontal tubular supports of traffic lights. These hardy birds have adapted their lifestyles to modern technology and are thriving as a result. Be on the alert for these nest sites; point them out to your pupils, if you see them. If there are none in the immediate school area, urge them to look elsewhere.

6. Tree Roots. There may be visibly exposed roots of trees in your natural site that have occurred through soil erosion. You can use the visible roots as touching-off points for a discussion of tree roots.

a) What is the job of tree roots? Besides providing water and nutrients to the tree, the roots anchor the tree and allow the tree to stand upright.

b) Why does the base of the tree spread out? What would happen if it did not?

c) How far away from the base of the tree do the roots go? If the roots of the tree are exposed, the children can try to follow them outward from the base. A good rule-of-thumb is that the roots of a tree extend as deeply as the tree is tall, and as wide as the tree's branches. So, by making a ring by holding hands under the outermost branches, the pupils can determine the approximate diameter of the tree's roots.

7. Much mathematical work can be brought into the engineering and structural principles of trees including their ability to stand tall; how tall do they actually get; how can you estimate the height of a tree; what is the *circumference* of a tree trunk; what is the *diameter* of a tree trunk; how does water get to the tops of tall trees (against gravity!); compute the absorbing surface of roots (WOW!), etc. Such investigations would be especially suitable for mathematically gifted pupils. Nature has provided us with many mathematical marvels. We will consider more of these math possibilities in later chapters.

8. Seed pods. In some cases, seeds are more visible in winter than in the fall, especially on top of snow. The seed pods of the *ailanthus* (Tree of Heaven), so common everywhere, are in clumps. You may find prickly sweetgum pods. In the autumn, the pods may be green and be tightly closed. By February, the pods are brown, have dried out, and in drying, opened their seed-bearing cavities. Birds eat these seeds. Pupils can try to count the seeds produced by a single pod, estimate the number of pods and seeds to determine about how many seeds a single tree can produce in one year. Of these, how many germinate? How many grow into actual trees? Why does a tree produce so many seeds? What provisions are made for their distribution (dispersal)? And if trees produce so many seeds, why do we need to buy seedlings from a tree nursery?

Plant the seeds of inquisitiveness about living things in your pupils. Encourage their natural curiosity; arm yourself with enough knowledge to point your pupils in the right direction. Then, they too, will branch out and blossom.

March

"One touch of nature makes the world kin."

—William Shakespeare

March

Although March indeed "came in like a lion," it will surely "go out like a lamb," as the ravages of winter recede and the reemergence of dormant life becomes apparent to those who take the time and interest to look. What are some of the early signs of Spring that may be seen and heard out of doors? Remember to wear waterproof footwear to keep your feet dry and remind the pupils to do so too.

1. Spring will arrive officially between March 20–22. Check your newspaper for exact day and time. We know it is the *vernal equinox*. *Vernal* means Spring and *equinox* that the day and night are of equal duration. But have you ever wondered why an exact time of its arrival can be given, or why sometimes it occurs on March 20th, 21st or 22nd? The explanation is that scientists consider that the changeover from winter to spring takes place when the sun crosses over the equator as it travels from the southern to the northern hemisphere. This can be predicted and computed precisely and then re-stated in a particular time-zone time. It does not occur at exactly the same time or place each year. As an activity for your class (or self), begin to observe (or continue) and record, via drawings or writing, the place and time the sun rose and/or set on that day. Compare these findings to those done in September (see *September*, #1) at the autumnal equinox, and December (see *December*, #1) at the winter solstice. And don't stop. Continue making periodic (weekly) observations (3rd grade and up). In this way, the barely perceptible changes that occur every day become more apparent. If you did shadow studies (see *December*, #1), mid-March would be a good time for a comparison study.

2. The thaw. In parks, in suburban and in the rural areas surrounding our city, rising temperatures cause the water locked in the frozen earth to begin to melt. Tiny rivulets and puddles appear on our land. In more hilly areas, water may pour down the sides of road cuts. Highways, roads, buildings and homes, if properly built, should take into account this Spring run-off (note the ditches on the sides of roads). Some places know too well the flooding that has occurred as an end result of poor planning.

3. Next time it rains heavily, bring your class to an upper floor room that overlooks neighboring streets and direct them to look out the window to observe the direction of the flow of water, especially if it gathers in places near the school, or turns a corner. Each area has its own drainage pattern which becomes apparent during a rainfall.

Why does water run down a curbside and not in the middle of a street? Why does it run towards a street sewer, even on a seemingly flat street? Is the street really flat?

The importance of this thaw and run-off to watershed area, as rivulets join to flow into our rivers and reservoirs, might be an apt tie-in with current events and recurrent drought.

4. As the frost melts, plants react. Here is a good activity to try with 3rd graders (and up). Give each child an ice cube and a straw. Challenge them to attempt to suck up water from the ice cube. Obviously, while water is in the *frozen* state, this is impossible. Only when water is a *liquid*, is this possible. Since plants obtain their water through roots, it is only after the ground thaws that plants can get the water they need. As the ice cube begins to melt, the water will be able to come up the straw. This activity can precede a walk outdoors to observe the buds on trees and shrubs (see *December*, #6). Before the buds can open, they require water. As the soil thaws, the water begins to travel through the circulatory system of the plant, the buds take in that water, swell, and finally bloom.

A good math activity can be started at this time. Find a young tree and measure its height. Check it again in June to determine how much upward growth may have occurred during these three months. Measure the circumference too, and note any changes.

5. Along with the other harbingers of Spring—the crocuses, pussywillows, forsythia, and skunk cabbages—some trees are early bloomers. Red maple trees are among those that flower in early Spring; their flowers are red and that is where the tree gets its name. However, it is easy to overlook the flowers that bloom on these and many other trees because they do not fall into the category of "showy flowers," that is, those having colorful petals and/or an enticing smell. On the contrary, they are often inconspicuous and if you did not know they were there, you might miss them. The colorful and odorous flowers require insects for pollina-

tion hence the color and scent *attract* the insects. Many tree flowers are *wind-pollinated*, thus many bloom before the leaves unfold; color and smell would be non-productive for these plants. So be sure to take careful notice of tree flowers on street trees, too.

You might wish to start a Nature News Notices section on a bulletin board. Post current items plus any timely topic from newspapers or magazines. For example, as soon as you observe the maples in flower, post it. Encourage your colleagues and pupils to join you. This way, you can have more "up-to-the-minute" sightings.

Take note also of the increasing "yellowness" of willow trees at this time of year. Other trees have distinct color changes just before they bloom.

6. Another of the insect "leftovers" (see *February*, #4) that may still be around are the dark jelly-like egg masses of the various tent-caterpillars and web-worms (gypsy moths are one of these). When the larvae emerge from their eggs and start feeding on the young leaves of trees (they especially like cherry trees), you will recognize their familiar silken web that they spin and live within, in the crotches of tree branches (late summer/early fall emerging species favor the *ends* of branches). Unless there are many of the egg masses on a single tree, chances are that the tree can withstand the partial leaf loss. The caterpillars are also an important food source for birds. You may not, however, wish to harbor these pests on your lovely street and lawn trees. If so, don't wait; examine the trees carefully now and prune off twigs bearing the egg masses *before* they hatch. (Indiscriminate spraying has been ineffective in controlling these insects; indeed, the poisons kill the natural predators as well.)

7. Your *ears* will also tell you that Spring is on the way. One of the sure auditory signs is the emergence of the Spring peepers. These tiny (1 inch) tree frogs have spent the winter in a semi-dormant state, holed up in the mud at the bottom and sides of ponds. As the ground thaws, they all come out at once and can be heard sending out their calls for mates. They produce the sound by expanding pouches in their throats. However, they usually chirp at dusk or after dark, so their sound may not be heard while school is in progress. Perhaps you could create a homework assignment that would encourage children to take a walk in the neighborhood with their parents or friends, carefully listening for evidence that the area they are investigating does indeed provide the habitat for these thumb-size amphibians. The sound may remind you of crickets, but the season (late March/early April) and place (wet) is the tip-off that they're frogs. The pupils could refer to (or make) a neighborhood map, indicating the exact areas where they were heard. If your neighborhood doesn't have a wet area, try to find one and tape-record the sound to play for your students. You will hear them if you are attuned to the sound. When driving your car, keep the window down and radio off; you'll hear it when you pass marshy areas, even at a distance since the cumulative voices are very loud.

8. Your ears can also hear the different sounds the birds make as the weather warms up. Once again, if you tune in, you will hear the sounds of returning and passing migratory birds. If you hear honking, after you've made certain it's not a car, look up; it may be a flock of geese (or ducks) on their northward flight, an awesome sight.

Early Spring is a time of nest-building, establishing territory, and mating. There is much flurry of activity in the bird world, accompanied by vocalization at this time. A whole chapter could be devoted just to this topic. For now, I'll just encourage you to be attentive to the sounds of birds; try to relate the sound you hear to the activity you see. Encourage your pupils to do likewise. Our ears are so assailed by traffic, radios, voices, that it is refreshing to just stop and stand quietly for a few minutes to listen to the sounds of the natural world.

One technique I have used successfully is to utilize a fire drill to have kids listen while they are standing out of doors on a lovely Spring day (they are supposed to be quiet anyway). Once they get the idea that if they are quiet they'll hear a mockingbird, mourning dove, or bluejay, the teacher doesn't have to scold to get total silence. Besides, the streets are much quieter during the hours when school is in session; much more is audible then.

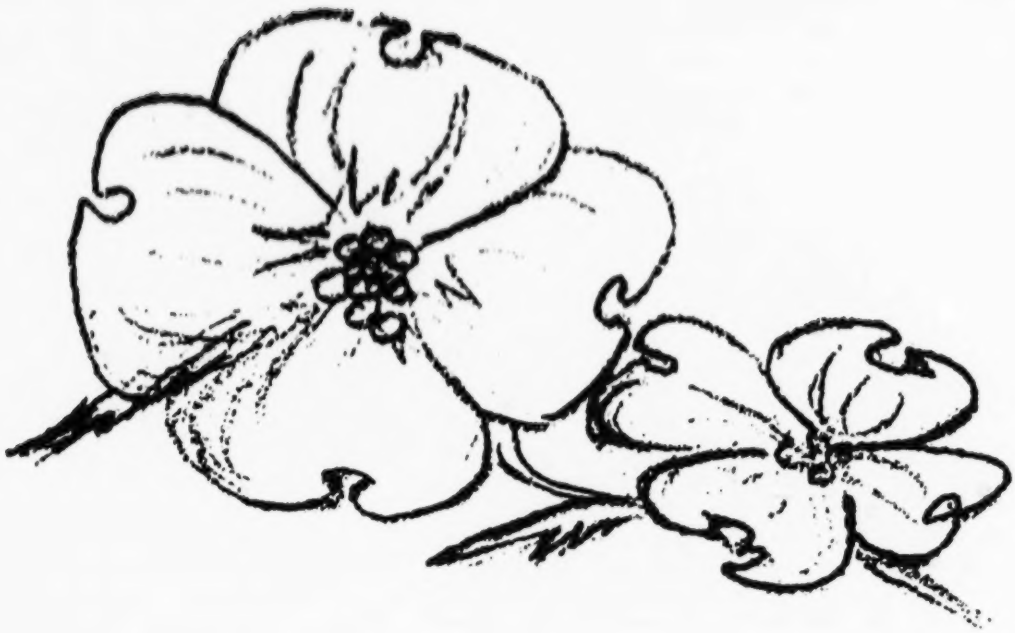
9. An important concept for older pupils to ponder is *interdependence*. In the science programs in many schools, pupils have observed animals feeding on plants, and animals feeding on other animals in terraria. When we consider, for example, the return of migratory birds, we realize they could not return if they did not have food to eat. If they are insect-eaters, consider that the insects that hatch and emerge in Spring could also not do so, if they did not have the food *they* eat. The plants, then, as the food producers, permit the food chain to resume after its winter dormancy. They grow, photosynthesize, and provide food for insects, which provide food for birds. . . the many parts of the system tie into each other.

In our daily lives, as we rush from home to school and back again, from one activity to another; as pupils run from school to music lessons, homework, T.V., or skating; as we drive from place to place in our cars, socializing, chatting, moving quickly, we are depriving ourselves and our children of some of the more meaningful pleasures and experiences that life can offer. Nature and its wonders are all around us if we only take the time to notice and savor it. Knowledge about natural systems can greatly enhance that experience.

April

"Hurt not the earth, neither the sea, nor the trees.

—Revelation 7:3



April

There's no need to look at a calendar to tell you that it's Spring—the signs are all around and quite visible. Pale green leaves have bloomed; flowers are opening their pink and white blossoms. Birds are noisy, and there's a special scent of young growth in the air.

Remember when your mother put the bedding on the clothesline or out the window to capture that smell? Now we have no clotheslines, but laundry baskets will do the trick just as well.

April is a month of rapid change, and the changes are very apparent within a short period of time. Overnight, changes occur, so you must capture the moment. Outdoor walks present many opportunities to sharpen the observational skills of your pupils, especially if you take them out early in April, and then at the end of the month.

1. Call their attention to the *colors*. Are all greens the same? If you go out on a balmy April day, you might bring art materials with you. Find a comfortable, picturesque place where pupils could sketch or color on lap boards. Cra-pas or pastels are especially effective media for duplicating the subtle colors of a spring woodland. Some Spring flowers may make their appearance and you should be on the alert for them. Include an announcement of these on the Nature News bulletin board for up-to-the-minute observations.

2. Insects are emerging from wherever they were over the winter (see *February*, #4). The first warm (60°F.+) day will be marked by the appearance of a variety of species. We might see the ladybird beetle on shrubs and trees. They are everyone's favorite, perhaps because they are so colorful, so tame and friendly. But far more important, these black-dotted, red insects are very beneficial since, in both larval and adult stages, they eat many harmful insects, like aphids. Don't kill them! The appearance of one of these creatures would be a good occasion to discuss the fact that not all insects are harmful (many people have an aversion to insects and do not realize their place in the biological scheme). They are an important part of the food chain, and many of our most loved birds are dependent on insects as a food source. Another interesting observation about ladybird beetles (and all other beetles) is that the wings are hidden under an outer covering; sometimes the ladybird doesn't tuck in her wings completely, and they stick out a bit (not much of a lady!). The ladybird also has the ability to "play 'possum." One wonders about the derivation of the age-old "Ladybird, ladybird, fly away/Your house is on fire and your children are burning." Capture one in a vial, put in some grass or leaves, look at one closely with a hand lens, but be sure to let it go. Encourage older pupils to research specific insects.

3. The dogwood, which is illustrated on the first page of April's chapter, is a beautiful, early blooming tree. Some people may have the pink or white dogwoods on their lawns, but they also grow wild. State departments of environmental conservation often make these and other seedlings available inexpensively. A close examination of the "flower" of the dogwood, using a hand lens, and comparing it with an unopened or just opening bud, will show that it is not really the flower at all—the flower is within. The showy, colored "petals" are really the inner parts of the bud coverings, called the *bracts*. The notches (or teeth) at the edges of these bracts are where the closed buds are held together.

4. Birds are returning from warmer climates—building nests, raising young. Watch for birds with bits of nest-building materials in their beaks. See if you can spot where they take it. Birdlovers place pieces of yarn, strips of fabric, etc., in their yards to make sure their beloved friends will have a supply of home construction materials. Some folks even go so far as to take the sweepings from barber shops and beauty salons, since many birds use human (or animal) hair to make a soft, inner lining for their offspring. (Nests are primarily nurseries for the hatching and rearing of the young.) Most birds build new nests every year, but it is illegal to take any bird's nest in most states. Some birds lay their eggs in other birds' old, abandoned nests; even mice will "refurnish" an old nest for their own use. If you have a fallen nest, however, examine it closely. Try to determine of what materials it was made (twigs, grass, straw, mud, etc.).

Birdwatchers can often determine the species of bird from examining the nest. If a pupil brings in a nest, many activities can ensue:

a) Using a key, or other research materials, they can attempt to identify the bird builder.

b) Younger children can just guess the bird from nest size and place where it was found.

c) Using tweezers and a large, spread-out area (big table covered with white newsprint paper), the nest can be taken apart, the materials sorted in various ways (size, nature of materials, etc.) and identified. CAUTION: This activity is NOT recommended for younger pupils nor should it be done in summer or fall. Many parasites live among birds; the birds' droppings may attract others. THE *TEACHER* SHOULD DO THIS ACTIVITY WITH PUPILS LOOKING ON.

d) As a mass exercise, a pupil can count the components, and realizing that a bird has no hands and can only use his/her beak to carry *one* thing at a time, can calculate how many flights it would take for a bird (or pair) to go back and forth in creating just one nest. In this way, you will marvel at the engineering feats of these miniature construction workers—working with mud, twigs, hair, seed fluff—molding, weaving, mortaring and securing the nests, all without benefit of higher education.

Incidentally, like other animals, most birds do not dirty their own dwellings with excrement. They will remove the droppings of their babies and drop them on the ground.

Look for birds' nests in trees; listen for the "broody" chirps under eaves and in unusual urban sites where birds manage to establish homes, like your air conditioners.

We will talk more about birds and the raising of their young in future chapters.

5. Somehow I can't get away from birds; their biology and behavior never ceases to amaze those who study them. One observation that can be made (get into the habit of looking up, you might see the things described) is the "thermalling" of gulls. You may see gulls, soaring on thermals—hot air currents that rise. The gulls do not flap their wings at all for this, but using their wing and body structure, just sort of hover and allow the upward current to lift them to the higher altitudes in a spiraling fashion. They do this sometimes in large flocks of 100-200 birds, and the resulting spectacular phenomenon is that of birds on every level of the helix (spiral) for several hundred feet, ascending like passengers on an aerial escalator, or a heavenly spiral staircase, until the whole system dissipates as the air cools at higher levels.

If you ever have a chance to ride the Staten Island Ferry, you'll see gulls "hitchhike" across the harbor to and from Manhattan (without paying fare, or even flapping wings). Watch them as they catch the warm air from the rear exhaust and move with the boat, stopping once in a while to dive to the water for food. Consider taking your class on a trip to Lower Manhattan, and then for a ferry ride to observe this, as well as the sights seen in the harbor.

6. Some trees, like the birch and willow, bear *catkins*, instead of the usual flowers. The "pussies" of the pussy willows are actually catkins. Catkins are really petal-less flowers that grow along a drooping, central axis instead of the more familiar radiating way. In addition, a tree bears either male or female catkins. They are therefore

pollinated by wind or insects. When we cut the pussy willows shortly after the fuzzy pusses appear, we will interrupt the growth. The pusses will remain that way indefinitely, if they are not in water, and are decorative.

However, if you wish to have your children study these sample catkins, put the stems in water and wait for the catkins to continue growing until they produce the yellow, pollen-producing stamens or green pistils, or seek out a live growing one. It might be fun to have students guess whether they'll be male or female. A hand lens will reveal which is which, as will the powdery, yellow pollen which comes off on your fingers if it's male. The pollen itself can further be observed through the microscope. A student could research the other catkin-bearing trees. How many different kinds are there? When do they bloom?

Students might also be interested in knowing that Indians chewed on the inner bark of willows to relieve pain and fever. Mr. Bayer made himself a fortune and helped us when he used this to extract the salicylic acid to produce aspirin.

7. Classes are decorating their rooms for the coming holiday seasons. Many of our spring holiday customs and symbols of Easter and Passover have their origins in the renewal of life and fertility at Springtime—the rabbit, lamb, eggs, greens, chicks. Our ancestors, religious and pagan, celebrated the regreening of plant life and the birth of animals. Their lives were more intimately entwined with nature than those of modern man. Although we are further removed, we are just as dependent on nature's bounty and fertility for our own survival.

8. Arbor Day is in April. Every school should hold a tree planting and ceremonies to mark the occasion. This makes everyone aware of the importance of trees to our well-being.

The message of the spring season is re-awakening, revival, new life. Take part in this with your pupils, and explore the outdoors world in April. The promise of summer is in the air.

May

"Nature has made neither sun nor air nor waves private property: they are public gifts."

—Ovid

May

May arrives in a splash of *color.* There is color everywhere; the sky is at its bluest, the grass its greenest and all around, flowers and gardens are at their loveliest.

If we are not facing a drought situation, it is the best month to savor the icy coldness of our drinking water. Perhaps it is the Spring run-off from the melting of the ice into our reservoirs that makes water its most delicious in May. Remember, water heats up and cools at a slower rate than land. However, leave the running of the tap for a year when we are not threatened by water shortage.

May brings the softness of late Spring to natural areas. Because the days are not really hot yet, it is probably the very best time to take your class out of doors—perhaps for some poetry reading or writing, sketching or just on a search for the wildflowers that grow. Late morning is my favorite time, but within a school day, it has to fit into a schedule.

1. *Wildflowers.* What kind of wildflowers can we see on a May walk? There may be violets or dwarf cinquefoils, a small yellow 5-petaled flower, or others. Purchase one or a few inexpensive pocket guides to wildflowers (see Bibliography). Remember, we cannot allow pupils to pick wildflowers; just multiply your children by the number of classes, and you will realize that we would deplete whatever flowers we do have. It is just as satisfying to look and appreciate; the teacher could pick *one* and pass it around for a closer look. If you wish to study flowers as a science lesson, you would do better to obtain ready-to-discard flowers from a friendly florist, or from your own garden.

The most pervasive and persistent wildflower is the *dandelion.* It is not a good sample for studying the "parts" of a flower, like pistils, stamens, etc., because it is a composite, i.e., each of those yellow "petals" is really a complete female flower*et* (floret) in itself. Nevertheless, the much maligned dandelion has a great deal going for it, worthy of further study.

Some consider it a weed and guard their beautiful lawns against its invasions; others relish its leaves in a salad and use its roots which, when roasted, make a drink. In some places, the flowers are made into wine! What makes dandelions great for students to study are: You can always find them, you don't have to worry about rare species, they occur almost all year, and you can pick all the stages at once. Use of a hand lens is necessary to see all the tiny parts.

Here are some activities to do with dandelions:

a) Use a hand lens. Try to find the pistils for each floret. See if you can see the sticky pollen on them. Try to find the stamens in the center. Then, tear the flower apart to better see the parts. This can also be done at various stages (see d. below). Compare the florets at the center with those at the edge. Which seem to be more mature?

b) Consider what attributes the dandelion possesses that make it so persistent. What function does that flat, rosette-shaped leaf arrangement do for it? What happens when a lawn mower goes over it? Or when you step on it? Or cut it? Does it grow back? Did you ever try to get rid of dandelions? Was it easy? What about that long tap root?

c) Moreover, dandelions adapt rapidly; those you find on mowed, managed lawns have short stems. Those growing elsewhere have long stems. Have your pupils collect and divide the flowers according to location found. Then, measure the stems to see if there is a correlation. The results can be graphed.

d) When you are picking dandelions for studying, try to find every stage the flower goes through:

immature flower bud
unopened flower bud
newly opened flower
slightly older flower
closed flower (after pollination, the flower closes again and rests before re-opening, now with seeds)
newly opened seed head
ready-for-dispersal seed head
empty seed head

Just like arranging story events in sequence, a reading skill, the dandelion can be lined up with all of its stages

visible at one time. It retells the story of the life cycle of a plant—all there in front of your eyes. Equipped with a good lens, the minute marvels will become apparent, from the curly, sticky pistils, to the barbed seeds (barbed to better hold where it lands), to the feathery umbrellas that catch the wind and sail the seed over long distances. Even the empty seed head can be examined to see where each tiny seed sat. You can also observe, by removing the seeds from a puffer, that the head's surface changes from concave to convex as it matures, thus giving that extra "push" to expel the ripe seeds.

So the next time you see dandelions, instead of cursing them, admire their tenacity and ability to adapt. Accept their beauty as they dot the landscape with touches of bright yellow. Above all, take the time to look at them closely.

2. While searching for dandelions on our lawns or elsewhere, take a closer look at *grass*. What is grass, or really, what are grasses? It is actually a botanical family whose members include the grains we eat, and also pesty phragmites, as well as the more familiar lawn coverings. Pull out a few plants and take them apart. The identifying characteristic that makes the members of the grass family belong to it, is that the leaves emerge in steps from sheaths that are layered one within the other. You see this when you pull apart the grass.

The grasses from managed lawns, grown from seed, or planted as sod, have been chosen and/or bred for the greenness, wideness, upward straightness and other qualities considered desirable in a lawn. Wild grasses are more varied, naturally. Try to find the small grass flowers which look more like seeds. (Picture wheat or corn, both grasses. The silk of the corn is the stamens.)

Your pupils can take a section of lawn (on parkland, school or theirs), perhaps a foot or 10 cm. square (use string) and try to count the number of grass plants. Are they all the same? Do they find anything else besides grass there?

To compare, take them into a wooded area and look at the clumps of grass growing there. Is it the same kind of grass that grows on a lawn? The grass of golf courses is also a different type.

3. It is easy to mistake clumps of *wild onion* (some call it wild garlic) for grass, because from a distance, the resemblance is close. A sharper look and sniff will immediately tell you otherwise. The onion blade is round, not flat, and smooth, and comes to a point that flops over. There are no sheaths within one another. Be sure to pick some if you see it, crush it and take a *small* taste (it has a *powerful* flavor). Pull a bunch up by the roots and examine the bulbs. Indians used it for flavoring, and some people still pick it and use it in cooking. It is a hardy plant, and you will see it growing all over.

4. You may find *ferns* growing in a wooded area. They provide interesting material for study, as well as beauty. Look for cinnamon fern, royal fern, bracken fern, New York fern, and sensitive fern. Watching them uncurl their fronds is fun... perhaps the students can readily understand why the uncurling fronds are called "fiddleheads." It is hard to believe that these tight curls possess within them the complete fern, tightly compacted. Ferns are very old plants, having descended from the giant ferns that were present at the time of the dinosaurs. Fern fossils are common in coal deposits; in fact, much of our coal comes from compressed ferns. It may be possible, as with the dandelions (#1d), to see the various stages in the unfolding.

Later, as Spring becomes Summer, and the ferns mature, it is interesting to turn the fern leaves over and examine the dot-like spore cases on the undersides. (Note: Ferns are a protected species and should not be picked.) If you find some spore cases ripe and ready to release spores, carefully excise a few and try to get some under the microscope for a closer look. For field work, hand lenses will suffice. Fern guides are available (see Bibliography).

5. One of the most remarkable phenomena of nature study is its adherence to basic laws of mathematics. These phenomena are most readily observed in plants. Take, for example, many common weeds that grow anywhere. Look at them alone from the side and from above. Note how the leaf stems (petioles) emerge from the main stems, sometimes at perfect right angles, or other mathematical arrangements. Other geometric forms, e.g., perfect 5-pointed stars, or 3-petaled flowers, or square stems may be found. Consider the symmetry we teach in art lessons. Nature invented it first! When you are out for your Spring walk, be aware of the symmetry and geometry in plants; point it out to your children.

Another activity that is math oriented, is one of progressive patterns. For example, challenge your pupils to provide the next number in this series:

1, 1, 2, 3, 5, 8, 13. . . . . .

Some of the better math students (4th, 5th and higher grades) might realize that each number in the sequence (except the first) is the sum of the two numbers preceding. Thus, the next number would be 21, then 34, etc. What's more intriguing is that many plants follow this sequence (known as Fibonacci numbers) in their structure. The garden sunflower petals and seeds are so arranged, as are the scales of pinecones.

An entire chapter, even an entire book could be written about math principles in nature (I'm sure it has been done). This is just a small glimpse of another way to look and marvel at the world we are part of.

6. From math, we can skip over to earth science and geology. In some of our readers, we can read about the Ice Age. It is not necessary to be that knowledgeable about geology. . . once again, just be aware of the possibilities that outdoor education affords if we only stop to examine the environment of our home, the Earth. A geology "tour" could begin with a look at the school building and a discussion of the materials that went into its construction. It is not important that you identify the exact minerals or rocks anything is made of. Most elementary age children will not remember names like feldspar, calcite, mica, schist, etc. They probably could not distinguish igneous, sedimentary and metamorphic rock. But that does not matter. What does matter is to have your pupils realize that whatever we do use is a product or resource of the earth itself. So examine the bricks outside, any marble (with or without fossils), the sidewalk, the curbstones, the stuff the street is paved with (where *do* we get asphalt and concrete from?). Then, look at some of the stones and rocks they may see. Try to decide if they belong in that place or were dumped; if they are "natural" rocks, or man-made (concrete). Maybe someone's father is a bricklayer, cement worker or mason. Let the pupil research the raw materials and find out exactly what it is, how it is mined and refined or processed. They should trace it back to its source.

Children do love to collect rocks, and they especially love the flakes of mica or anything colorful or sparkling. Many rock identifying books are available and the American Museum of Natural History's Mineral and Gem display is a super excursion.

A second "tour" should go further afield to examine many of the boulders that may be on the land. Some may have been dumped by bulldozers clearing land elsewhere. But many have been here, in their exact places, for thousands of years. They do not belong here; they are not rocks from under.our ground that have come up. They were carried here by the last glacier that slowly worked its way south, pushing the rocks in front of it, during the last Ice Age, about 25,000 years ago. They bear the scars of their journey, which can be seen if you look carefully. These boulders, so-called "erratics" are interesting highlights. The glacier stopped in a definite line across our continent including areas of New York City and Long Island. The place where the glacier stopped and began to recede is known as the "terminal moraine." This action left many rolling hills and valleys and lakes.

7. Children love to lift up rocks and it is pretty fascinating to discover just what is living under a rock. That's the place to locate salamanders and also ant colonies. It is hard to resist lifting up the rock to watch the ants scurry about, trying to protect their eggs and grubs, or to catch a glimpse of the elusive millipede. We must temper our curiosity somewhat by not making it a practice, since so doing can destroy an animal's protection. It could be done perhaps *once* on a walk, and then always with the admonition that the rock must be quickly put back. Creatures who live under rocks do so because they cannot cope with light and/or drying. If you have a clean up, you might decide to leave some boards and such on the land because animals will have established homes under them.

Upper grades could carry out a simple experiment on the school grounds in various places, or even at home: Cover a small area (10 cm^2) with a piece of board and leave it for a week. After the week has passed, lift the board and observe any changes. If it is not a decorative lawn, the board might be left in place indefinitely and examined periodically. Certainly the lack of light (and retention of moisture) will at least cause observable changes, as the leaves of grass lose their green color. This is an effective way to teach the role of light in photosynthesis. The longer term experiment might produce many other results. Who will take up residence? What will happen to the soil underneath?

8. We could not leave the month of May without mentioning our feathered friends. When did you see your first robin? Do you notice the birds in pairs? Much of the squabbling is a competition for desirable territory and mating rights. Some birds pair for a season, some for life, some not at all. It's nest-building, egg-laying and baby-raising time (different for different species). Catch a glimpse of a feeding parent as she (or he) brings bits of food to the nestlings. Later in May, some baby birds begin to fly. If you are lucky, you can witness the teaching process. Often, a fledgling leaves the nest before it is quite able or ready to fly. Mother may then come to wherever it is perched or hiding to feed it there. There is a special distress call which you can discern when you hear it...it repeats at short intervals. Listen for it in late Spring.

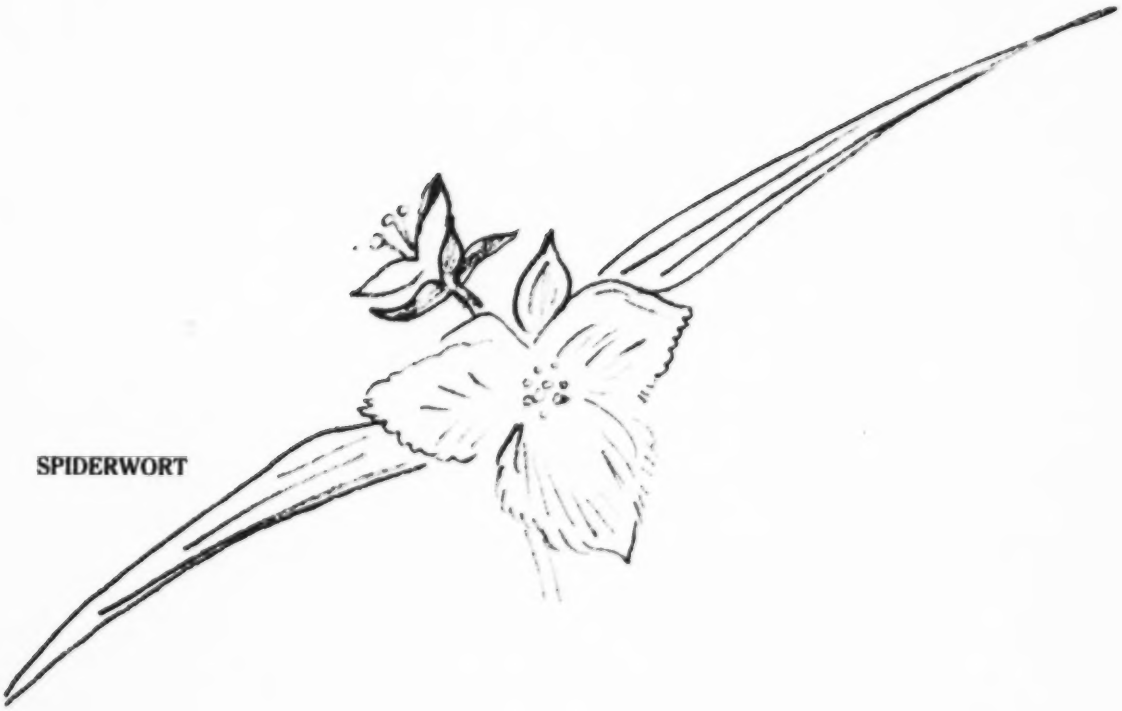
Humans have much of their animal ancestry still within their anatomy and psyches. Like the birds, Spring is our time for nesting; people house-hunting increases dramatically in Spring. And for those who "found" their nests, it becomes the time of Spring cleaning as we spruce up our nests, painting and cleaning. Since we are kin to all of nature anyway, we should be able to empathize with all the inhabitants of the Earth as the revival of life in Spring shifts into second gear.

Enjoy May, the most beautiful month of the year.

June

"In Nature's infinite
book of secrecy,
A little can I read."

—Shakespeare



SPIDERWORT

June

June comes in with a rush; the rising temperature provides the impetus that results in very rapid growth. Pulling out weeds from the garden becomes a tiresome chore; yet it is testimony to the successful struggle for survival.

June looks quite different from May. The pale greens of new plants have been replaced by the deeper hues; bare earth is covered by profuse growth.

When you go into any natural area, be careful of poison ivy. Consider using a weed killer beforehand on some of it, but don't destroy all of it. *Teach* what poison ivy looks like so it may be avoided. It is also a food source for rabbits and other wildlife. Just make certain you are able to identify it and steer away from it. Since it prevents people from walking off the trail, it also protects species and habitats from being wantonly destroyed and trampled.

What will we find of interest outdoors during June? Growth is so profuse, that it becomes confusing. . .there are too many plants and insects to be seen. The tendency is to, therefore, not look carefully because the untrained eye is bombarded with too much information and cannot decipher what is being looked at. Repeated exposure, trial and error, and a little assistance from assorted guide books can help. We will concentrate on the more obvious sights and sounds in an attempt to pull out from the multitude that which we can most readily observe. (N.B. For comfort, you might want to use insect repellent. Several brands are very effective.)

1. The *summer solstice* will occur between June 20-22. If your class has been making periodic observations and recordings of the sun and/or length of the day, they will now have come full circle. The first day of summer will mark the day when the sun will have reached its most northern position above the earth, as it reaches the Arctic Circle. For us, in our latitude, it will mean the longest day (and shortest night) of the year. Older pupils can check the newspapers for the exact times of sunrise and sunset and compute the exact length. As an enrichment for gifted math students, they could use calculators to determine what fractional portion of the total day is daylight/darkness, using newspaper figures, and examine the trend over the weeks and months to come. Does the process of change occur at an even rate? Where on the horizon does the sun rise and set?

2. One observation that you could make immediately when you walk from an open area to a wooded one is the drop in the temperature. Without having measured it, I would estimate at least a 10-degree drop from the area outside to that within. You could do a temperature study with your class; have them take readings at different places; speculate on the reasons for the change. What is the dominant feature of a forest? How do the trees cause such a distinct drop in temperature? What is the added value, then, of planting trees on barren land, and of protecting those we have?

As we sit in our air-conditioned homes and cars (our cocoons?), we have forgotten how to use nature to help us keep cool. The new high-rise office buildings, with windows that cannot open, are proving to be white elephants. The Sunbelt migration could only take place because of artificial means of cooling; is this so desirable?

3. How do some members of the natural community cope with the heat and direct rays of the sun? One tiny insect, which makes its appearance late in May and through June, has evolved a fascinating technique for surviving. While walking near any field or weedy place, keep your eyes down and try to find plants that have white, foamy globs on them. Kids of yesteryear used to call it "snakes' spit" because it looks like "spit" (saliva).

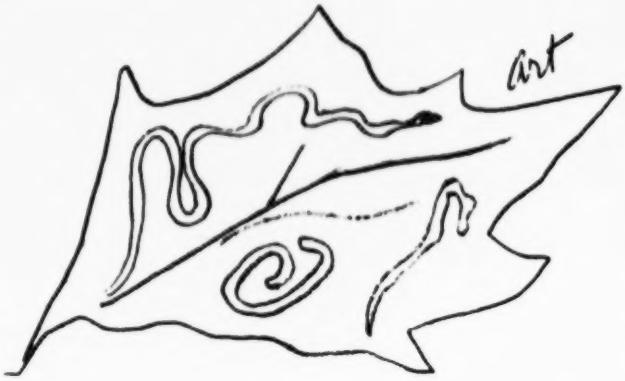
The frothy, bubbly mass will yield its creator upon close inspection. Use a blade of grass if you don't want to touch the stuff (it feels like spit, too) and locate the small (2-3mm) yellow insect, with its black eyes, buried within its wet coolness. You've found the "*spittle bug.*" Actually, it's the nymph (immature stage) of the leafhopper. It has developed this ingenious method of

protecting itself from predators as well as from the drying-out effects of direct sunlight. The adult will be winged and have a leathery skin to protect it, and it will be a great jumper. But the young one doesn't have the benefits of this protection, so it creates the froth and hides inside of it.

If you put one in a "bug box" (little plastic box with a magnifying lens) with some grass, you may be able to watch the froth-making process.

4. Some of the more interesting plants growing in wet areas are the *horsetails*. Horsetails are ancient and primitive plants; like the ferns, they too have survived from the age of dinosaurs, when they flourished and grew to tree size. And like the ferns, their remains are frequently found as fossils in the coal beds. Our more recent ancestors used horsetails to scour and scrub pots and pans. They have an abrasive quality because they contain *silica*. Your pupils could compare these plants with others, such as phragmites or lawn grasses. A lens can be used to look at the cross-section of one of these "branches" and where the branch is divided. Also, take a look at the places where the branches emerge from the main stem. The "points" that you see are remnants of leaves. Call attention to the *pattern* observed in the way the branches come out in *whorls*. If the plant does not contain leaves, how and where is food-making carried out? The horsetails do not produce seeds either, but reproduce by spores, growing an altogether different shoot to create the spores.

5. We can find many examples of another insect oddity in many leafy plants. Look for markings as shown in the illustration, on a variety of leaves.



These "tracks" are caused by different kinds of *"leaf-mining"* insects. The unusual thing about the *leaf-miners* is that they are so small, they live and feed *within* the width of a leaf, usually no thicker than this paper, munching away, without cutting through the top and bottom surfaces of the leaves. They are well-protected within their green homes.

Pick a sample or a few; have your pupils trace the path made by the leaf-miner. Try to have them figure out in which direction the insect went (HINT: The more it eats, the bigger it gets, so try to find the narrow end and trace it to the wider end). The insect's waste matter is deposited behind it. Later in the season, you may be able to locate the place where the insect has cut its way out of its leaf tunnel to live out the rest of its life cycle. Have your pupils hold the leaf up to the light; perhaps the tunnel borer will thus become visible. After looking, the "mines" can be opened to see if the miner can be found and scrutinized, once again with a hand lens (it's an indispensable tool for the would-be naturalist).

6. What's happening in the bird world in June? Develop the habit of looking upward. Some fledglings are trying out their wings and making the first flights.

Often you see a larger bird being chased by a smaller one. It may be a crow being attacked by a bird whose nest it was robbing of eggs or baby birds.

Many birds are not readily visible during June, that is, when they are in the trees, because of the heavy growth. However, they give us audible clues as to their whereabouts, if only we can discern and differentiate the bird calls and songs. There are sets of bird calls on cassette tapes, which you may borrow from libraries or purchase. There are also specially designed records that are on cards. Each card explains the bird and shows its picture, and by placing the card in a small hand-held player, you will hear a recording of the bird's song (see Bibliography).

Since people are generally more visual than auditory, being able to differentiate bird calls seems like an impossible chore. Start small—master 2 or 3 this year. Try for 2 or 3 next year, etc. You could probably do many right now. . . gulls, bluejays, ducks, perhaps the robin, maybe the mourning dove. Another way to develop the skill is by attending bird walks. Check your local nature center for the schedules.

If you are on a walk, you will hear many birds. If people plant trees and shrubs that will provide birds with food, the numbers will increase as time passes. By providing habitat, birds and other wildlife are encouraged to live there. Birds are also feasting on those awful tent caterpillars (what's bad for the trees, is good for the birds). Be sure then, to stop and *listen* for the birds. How many different calls can your class hear? Can you see the bird? Bring out a cassette recorder and try to capture the songs. Seeing and hearing the bird together does the trick of reinforcing the relationship; then, in the future, when you hear the song, you will know which bird is singing it.

To me, the most beautiful song bird popular in every neighborhood is the mockingbird. The variety of its songs are staggering; one wonders where the energy to sing so much comes from (birds eat great quantities of food for their size; if someone "eats like a bird," they'd consume perhaps half their weight each day). I have personally heard a mockingbird singing loudly at 2:00 a.m. and have taped its singing. Listen for it and try to locate the songster. They perch on T.V. antennas and telephone poles. Mockingbirds seem to be establishing themselves all over, and they are a welcome sight and sound, even after midnight. The mockingbird will have to be our "nightingale" since there are none of those "old world" birds in the Americas. You might follow up a listening trip with a reading of Anderson's story of "The Nightingale" or Oscar Wilde's "The Nightingale and the Rose." Nature has provided the inspiration for many artists and writers.

7. If you have been weeding, planting, or otherwise working in a school garden with your class, your children may have been curious about *soil* (or, as they call it, *dirt*). What is soil? How is it made? What are its components? Can it be lost? Can it be improved? The discussion of soil is a major undertaking, which I cannot do justice to in a few lines. However, a few items briefly:

a) Pupils who plant may not understand why we have to have *topsoil* for the garden. Had they attempted to plant without it, they would see the difference.

b) What does the placement of horse manure as fertilizer do for the soil? Why is this "good" for the soil, but at the same time we discourage dogs from littering?

c) How is the soil within a wooded area different from the soil in the other areas?

You could take kids out and have each one write a question about soil. These questions could then form the basis for research about soil.

You might consider starting and developing an ongoing *compost* pile, so pupils could learn how natural forces recycle waste into rich and fertile soil.

8. One inhabitant of soil that kids are always curious about is the *earthworm*. They (and you) may find them ugly and downright revolting, but nevertheless they are interesting and extremely valuable, especially to the farmer. Next time you are out with your class, dig up a bucketful of soil. If it's good soil, it will surely contain some earthworms. Earthworms perform several important functions for soil; as they move through the soil, they ingest it, with its various components, digesting whatever they can. As the partially digested soil comes out from the other end (it is called the worm's "castings"), it enriches the soil as a fertilizer. In addition, by burrowing, the worm creates tunnels, thereby loosening up and aerating the soil. Then, when it rains, the water can fill up these openings and get down to the plant roots where it can do the most good.

Many times, after a particularly heavy rainstorm, hundreds, even thousands of worms appear in puddles in front of the curb, drowned out of their tunnels by the water.

Darwin said about worms, "It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organized creatures."

As an activity with earthworms, you might bring with you a large glass jar, into which you could place a worm or two, with soil, and pile some dead leaves on top. Create a paper cover to fit around the jar since the worm, even without eyes, dislikes light. Set aside for a few days and uncover periodically to see if you can observe the burrows.

A related activity might consider soil absorption rate, comparing compacted soil with some that has been aerated by the action of the earthworms. The difference is quite striking.

Our species owes a debt of gratitude to the earthworm, for without it, our farms could not produce the harvest to feed us.

July and August bring us respite from the demands of curriculum and discipline. It is a time to relax and contemplate. It is hoped that this guide has helped you to appreciate the gifts that nature has given to us, and that you will spend some of the time looking at and listening to our earthly surroundings. With increased knowledge, one cannot help but be concerned about our environment and act accordingly. As teachers, it is our responsibility to pass this on to children with whom we are in contact.

The National Wildlife Federation pledge for children best sums up what we are trying to achieve for our children:

I pledge to use my eyes to see the beauty of all outdoors.
I pledge to train my mind to learn the importance of nature.
I pledge to use my hands to protect water, woods, soil and wildlife;
And by my good example, to show others how to respect, properly use, and enjoy our natural resources.

Let's try to get our students to understand and live by these words.

Have a great summer!

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National Wildlife Foundation	*Invite Wildlife to Your Backyard.* NWF 1412, 16th St. N.W., Washington, DC 20036.
	What's a Tree to Me? National 4H Council, Cooperative Extension Service.
	Audible Audubon, bird recordings. Available from P.O. Box 3519, Torrance, CA 90510.
	Spotters' Guides series. Birds, Wildflowers, Trees, Rocks and Minerals. Mayflower Books, New York, NY.

Some Helpful Agencies

U.S. Dept. Agriculture
Soil Conservation Service
23 New Hempstead Road
P.O. Drawer N
New City, NY 10956
(914) 634-9242

New York State Dept.
Environmental Conservation
50 Wolf Road
Albany, NY 12233
Also, World Trade Center
(212) 488-6146

Council on the Environment
51 Chamber Street
New York, NY 10007
(212) 566-0990

Botanical Gardens

Queens Botanical Gardens
43-50 Main Street
Flushing, NY
(718) 886-3800

Snug Harbor
Botanical Gardens
Staten Island, NY
(718) 273-8200

New York Botanical Gardens
Southern Blvd. & 200th St.
Bronx, NY
(212) 220-8745

Brooklyn Botanical Gardens
1000 Washington Avenue
Brooklyn, NY
(718) 622-4433

Others

Urban Park Rangers
(each borough office)
Brooklyn (718) 856-4210
Manhattan (212) 360-8194

National Wildlife Federation
1412 16th Street N.W.
Washington, D.C. 20036
Ask for their CLASS project

USDA-Soil Conservation Service
Nassau-County Unit
(516) 486-4744

Street Tree Consortium
3 West 29th Street
New York, NY 10001
(212) 578-4747 or (212) 679-4481

Horticultural Society of New York
128 West 58th Street
New York, NY 10019
(212) 757-0915

Environmental Action Coalition
417 Lafayette Street
New York, NY 10003
(212) 677-1601

Green Guerillas
417 Lafayette St.
New York, NY 10003
(212) 674-8124

Massachusetts Audubon Society
Lincoln, MA
(617) 259-9500

Gateway Environmental Study Center
Floyd Bennett Field
Brooklyn, NY 11234
(718) 252-7307

Alley Pond Environmental Center
228-06 Northern Boulevard
Queens, NY 11363
(718) 229-4000

High Rock Park
200 Nevada Avenue
Staten Island, NY
(718) 987-6233

Wave Hill Env. Center
675 West 252nd Street
Bronx, NY 10471
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Table of Contents by Specific Topics/Index

September

	Page
1. Shortening of the Day	12
2. Lowering of the Temperature	12
3. Monarch Migration	12
4. Migration of Birds	12
5. Evidence of Animals	12
6. Plants—Woods vs. Fields	12
7. Plants—Kinds and Numbers	12
8. Flowers—the Composites	12
9. Pollen	13
10. Leaf Color Changes	13
11. Leaf Loss	13
12. Seeds, and their dispersal	13
13. Leaf collecting—for Art	13
13. Ugliness in littered land	13
Note about collecting	13

October

1. Graphing temperature records	16
2. Phragmites	16
3. Autumn leaf colors—art	16
4. Bird feeders	16
5. Greater visibility with leaf loss	17
6. Counting seeds	17
7. Seed pods; acorns and pine cones	17
8. Harvest symbols; pumpkin	17
9. Built environment, interiors	18
10. Environmental issues, news	18
11. Television, VCR	18

November

1. Twigs, buds	20
2. Why leaves fall	20
3. Colors fade, wax	20
4. Leaves to soil	20
5. Pilgrims, getting ready for winter, wild food	20
6. Bird feeders—details	21
7. Apples	21
8. First snowfall	22

December

	Page
1. Winter Solstice	24
2. Evergreens	24
3. Winter feast for birds	25
4. Birds—who stays, who goes? by beak shape	25
5. How animals keep from freezing; down	25
6. Twig study	27

January

1. Snow	30
2. Snowflakes (art)	30
3. Haiku, cinquain	31
4. Looking at trees from afar	32
5. Eating snow, ice	32
6. Temperature studies	32
7. Freezing/Ice	32
8. Christmas tree recycling	33
9. Visibilities—birds' nests, squirrels' nests	33

February

1. Birds who stay north	36
2. Reptiles, amphibians	36
3. Mammals	36
4. Insects: mantis, bagworm, galls	36
5. Nest building	37
6. Tree roots	38
7. Mathematics and trees	38
8. Seed pods	38

March

1. Vernal equinox	40
2. Thaw	40
3. Rain	40
4. Melting and plants	40
5. Tree flowers	40
6. Tent caterpillar egg masses	41
7. Spring peepers	41
8. Bird sounds	42
9. Interdependence	42

April

	Page
1. Colors	44
2. Insects; lady bird beetles	44
3. Dogwood	44
4. Birds' nests	44
5. Thermalling	45
6. Catkins	45
7. Easter/Spring	46
8. Arbor Day	46

May

1. Wildflowers; dandelion	48
2. Grasses	49
3. Wild onion	49
4. Ferns	49
5. Math/Fibonacci	50
6. Geology—Ice Age	50
7. Looking under rocks and boards	51
8. Birds—behavior	51

June

1. Summer solstice	54
2. Temperature changes. Woods vs open areas	54
3. Spittle bugs	54
4. Horsetails	55
5. Leaf miners	55
6. Birds; Fledglings, crows, mockingbird	55
7. Soil	56
8. Earthworm	56

Staff and Sites

Myrna Cooper, Director
Clare Cohen, Assistant Director
Barbara Starsky, Coordinator, Afterschool Programs

260 Park Avenue South
New York, New York 10010
(212) 457-3737

Manhattan

Candy Cook
P.S. 20M—D. 1
166 Essex Street
New York, NY 10002
(212) 533-7177

Pam Barth
P.S. 40M—D. 2
319 East 19th Street
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(212) 533-0265

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123 Morningside Drive
New York, NY 10027
(212) 662-1127

Fran Blau
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500 West 138th Street
New York, NY 10031
(212) 927-9838

Bronx

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1020 Anderson Avenue
Bronx, NY 10452
(212) 992-1905

Virginia Danzer
P.S. 261X—D. 10
2507 Jerome Avenue
Bronx, NY 10468
(212) 295-2197

Rita Hirsch
P.S. 8X—D. 10
3010 Briggs Avenue
Bronx, NY 10458
(212) 365-0750

Arlene Smith
E/JHS 80X—D. 10
149 East Mosholu Parkway
Bronx, NY 10467
(212) 882-2348

Margaret Strauss
CES 47X—D. 12
1794 East 172nd Street
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(212) 931-2478

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CES 77X—D. 12
1250 Ward Avenue
Bronx, NY 10472
(212) 378-5087

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(212) 792-9694

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P.S. 93K—D. 13
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Anita Cimino
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Staten Island

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High School
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Johanna Mosca
Springfield Gardens H.S.
143-10 Springfield Boulevard
Springfield Gardens, NY 11413
(718) 525-2433

Dorothy Reinertsen
Theodore Roosevelt H.S.
500 East Fordham Road
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(212) 295-3511

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